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THE SCIENTIFIC APPROACH TO PHILOSOPHY

SELECTED ESSAYS AND REVIEWS

BY

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PREFACE

The essays in this volume are occasional, and, with the exception of the first, which is intended to give the standpoint from which they have been selected, have all been published before. My thanks are tendered to the editors of the following journals for permission kindly accorded to reproduce the articles: *Everyman*, *The Hibbert Journal*, *The Methodist Review*, *Mind*, *Nature*, *The Personalist*, *The Philosophical Review*, *The Times Educational Supplement*.

H. WILDON CARR.

April 1924.

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I

THE SCIENTIFIC APPROACH TO PHILOSOPHY

We are accustomed to think of philosophy and physical science as in their nature two completely separate mental disciplines, distinct in method, in aim and in principle. Accordingly in our Universities they are assigned to different Faculties. The leaders of physical science do not underrate the importance of philosophy as a human interest, but they account its value, so far as their researches are concerned, as indirect. It may give vigour to the mind; it can never give that command of the resources of the world, that solid contact with its reality, which science makes its primary consideration. The student who would do good work in science is warned off philosophy; and if he happen to be himself a philosopher, he is recommended to keep his science and his philosophy in watertight compartments, for association with philosophy will produce in science only obfuscation and muddle. "Physics beware metaphysics" is a maxim of science, and in the last century, the golden age of scientific expansion, it was claimed for science that it was marked out by the positivity of its knowledge from the negativity of metaphysics, which was considered to be unsubstantial speculation.

In the nineteenth century also there came into use a special term to denote those votaries of science who were determined to have no truck with metaphysical speculations. The word " scientist " was invented to designate such persons. The term is still in common use in a certain type of literature, although it is generally rejected by the higher organs of philosophical criticism. It was not meant to denote that the person so described was a good mathematician, or a good physicist, or a good chemist, or a good biologist, for a metaphysician might be all or any of these; it was intended to describe a negative attitude towards philosophy, the view that only science in its experimental form is positive, and that pure philosophy is of a nature like moonshine, a radiance investing concrete utilitarian knowledge with an air of romance and sullying the intellectual contemplation of theoretical truth with emotion, itself unable to present anything tangible to the student and actually wasteful in its expenditure of mental energy.

It is an entirely false distinction. There is a true distinction between philosophy and science, between philosophic method and scientific method, but it is not in their subject-matter; it is in the mind's attitude towards that subject-matter. Philosophy regards the reality of the universe primarily in its universal aspect as a whole. It seeks to conceive it in its unity and discover the principle of its integrality. The philosopher is therefore essentially synoptic in his outlook and systematic in his observation. In his study of nature he tends to put function before structure, life before matter, act before action, becoming before being. When he seeks to understand the mechanism of the parts he keeps in view their relation in the

whole. Science, on the other hand, starts with an ideal of abstractness. This is because its primary concern is with the particular. The scientific worker therefore must concentrate attention on the constituents of the reality which nature presents to him. He must particularize these constituents, and to do so he must narrow his view by excluding from the matter in hand everything which he can by any means regard as possibly irrelevant to their nature. He observes, notes resemblances and contrasts, sequences and consequences, for the purpose of discovering causal connexions and establishing natural laws.

From the standpoint of human knowledge both these attitudes towards the natural world are equally important, and for the attainment of wisdom in the practical conduct of life, equally necessary, but according to the emphasis which they impart to the direction of the mind towards the one aspect of the reality or the other, men are classed as speculative philosophers or as empirical scientific researchers. Let us take two notable examples. Spinoza and Newton were contemporaries, though they had no direct relations with one another, and Spinoza died some ten years before Newton published the *Principia*. In Spinoza we have the philosopher par excellence; in Newton we have the scientific inquirer eminent not only in his own time and among contemporaries, but for all time as a discoverer of truth. What is it then, let us ask, which constitutes in the one philosophic, in the other scientific, eminence?

It most certainly does not lie in the boldness of speculation of the one and the humility of patient experimentation of the other; both are pre-eminent in daring speculation and both are equally rigorous in

their logic and equally on their guard against errors which may be due to deceptive appearance or fanciful imagination. Each eschews romantic constructions, and aims at precise mathematical demonstration. Each will pass the test of the most rigid scientific criterion to which their methods in the search for truth can be submitted. Where they differ is in their approach to the problem. The philosopher proceeds from the whole to the parts, and never loses hold of the whole in his interpretation of the parts. The scientific worker proceeds in the reverse direction. He attends to the parts not as parts but as possessing reality in their own right, and by discovering relations he constitutes not systematic wholes but invariable laws. The comparison is most instructive.

Spinoza begins his systematic philosophical treatise, the Ethics, by expounding his concept of God. This would have been not only meaningless but also disconcerting were God for Spinoza a transcendent being. Had he conceived God as the creator of the world, it is clear that by any rational procedure the idea of God must be last and not first in the order of knowing. But God for Spinoza is the universal substance, the reality whose existence is involved in its essence, the unconditioned, the ground and source of all that is. It is essential to the understanding of anything which concerns the order of nature or the conduct of human life that we should first understand the nature of the universal existence from which the necessity of our particular existence is derived. We have not, in order to procure this, to transcend our reason and appeal to faith, either as represented by external authority or innate as an intuition; we have simply to use our reason. It is by reason that we

discern the conditioning existence which determines our place in the cosmos and the nature of our finite activity. In Spinoza's view the confusion and obscurity and error which characterize human science, the perversity and waywardness which distract human conduct and give instability to political institutions, all arise from reversing the rational order of knowledge. If we begin with sense we are forever prevented from rising to the comprehension of intellectual truth, just as by accumulating observations of the aesthetic forms of sense objects we can never attain the demonstrations of geometrical propositions.

Compare Newton's approach to the same problem. Newton's reflection concerns primarily the immediate facts of common experience in their particularity. The story of the apple may be apocryphal, but it is typical. Newton studies with minute experimental care, for example, the circulation of the water in a spinning bucket. He also makes accurate measurements of intervals and distances and of the velocities of moving bodies, with the object of discovering a ratio which will hold good irrespective of the actual quantities of the related masses. Thereby he succeeds at last in formulating a universal law of gravitation, and thenceforward this becomes the interpretative principle of all natural phenomena.

What is interesting in this comparison is to find that the urge towards perfect consistent rationalization of the world is the same from whichever standpoint we set out. The things which concern the faith, the acceptance or rejection of revelation, the credibility or criticism of the Christian theory, do not affect the comparison; to both they are irrelevant. The single purpose of each " natural philosopher " is to discover

the truth of nature by reason alone, and, starting from diametrically opposite standpoints, each is driven to greater comprehensiveness. Were we to pursue the comparison in detail we should find that Spinoza's difficulties multiply the further he descends from the species aeternitatis to the temporal order and seeks to justify the finite modes of the divine substance, and equally Newton's difficulties become really formidable when he seeks to define, as he must, space and time and their relation to God. For Spinoza the temporal order, for Newton the eternal order is enshrouded in mystery, or yields reluctantly to reason. Yet Spinoza and Newton have each the same directive idea, that of a nature or existence which in its universal aspect is completely amenable to rational interpretation.

It was not till the nineteenth century that the separation between science and philosophy became definitive and, for a time at least, irreconcilable. In the latter half of that century it is practically impossible to find any point of agreement between them; they have no common ground. In the earlier part of the century the Comtist doctrine of the three stages—the theological, the metaphysical and the positive—had given expression to the discordance between the two methods, and the Hegelian philosophy, with its dialectic of pure thought and its metaphysic of the absolute idea, had seemed to the workers in the sciences to be pointing in a directly contrary and opposed direction to that empirical method by which these sciences were making triumphant progress and undergoing marvellous expansion. There arose in consequence in contrast to it a philosophy which abjured metaphysics and became a hierarchical classification of the sciences themselves. The philosopher of science, if he special-

ized in philosophy, set up as a kind of independent expert adviser, ready to interpret facts and phenomena which others collected or described, and if he dogmatized, did so only in so far as he assigned the boundaries of a science, or decided the external relations of the different sciences to one another, or criticized the modification of method in the passage from one science to another, or determined the priority of the sciences in the hierarchy. The speculative philosopher of the Hegelian type was suffered contemptuously to go his own way, for at least he was the respectable representative of learning and culture, but science had as little use for him as Plato had for the poets in the Republic.

All this is changed, and the change can be traced back to two main sources in the science of the nineteenth century. Two of the sciences in particular, the science of biology and the science of electromagnetism, have required a re-examination of first principles. In each the search for truth has necessitated inquiries; in the one case into psychological meanings, in the other into the metaphysics of extension and movement, both of which the workers in the sciences would gladly have excluded, and have even persevered in thinking it possible to exclude, from their domain.

With the signal triumph of the Darwinian theory of the origin of species by natural selection, it seemed at first as though the most refractory of all the phenomena of nature, those, namely, which concern life and mind, were being brought at last within the scheme of universal natural law and mechanical causality. But soon a very urgent and definite problem arose within the scheme itself. What is that mode of

consciousness which we name intellect? Is it something in its nature absolute or is it itself a product of evolution with a purely survival value? Hitherto its absolute nature as a power of contemplating and ideally representing reality had been unquestioned. If it is subject to transformation and itself a natural selection by gradual elimination of less efficient types, where are we to go for our criterion of the positivity of science, the thesis on which the whole of the distinction of physical science from philosophy depends? The scientific materialists had no means of directly meeting this problem, but they thought it might be sidetracked. The only evolution their theory postulated was that of the structural forms which had given rise to species of living creatures. A modification of mentality accompanied all adaptations, but it seemed strictly co-ordinated with the structure of the nervous mechanisms. They supposed, therefore, that the growing complexity of the brain and the concomitant widening of the sensori-motor function was accompanied by an epiphenomenal consciousness, glowing like a phosphorescence, lighting up and informing the higher forms of protoplasmic activity.

This extravagant theory, which to most people to-day seems absurd, held its ground tenaciously throughout a scientific generation. Empirical psychology has rendered it obsolete. The crucial problem in psychology is the nature and origin of instinct. Mechanistic evolution, taking the intellect as absolute, had two and only two alternatives. Either instinct is lapsed intelligence or intelligence is instinct raised to a higher power. The one is inconsistent with the principle that evolution is a progression from the simple to the more complex with an accompanying emergence

of higher characteristics, for it would mean that in the case of mind the higher had emerged first and before the evolution of the complex neural structures which in man are its condition, and this for the Darwinian would be a direct reversal of the order of organic evolution. The other alternative, that with the evolution of brain there is an evolution of intellect from instinct, is unsupported by any evidence. Evolution presents many cases of instincts growing in perfectibility as species undergo transformation, but no single instance of instinct developing into intellect. Behind this scientific problem, however, there loomed a philosophical problem of the first magnitude and of fundamental importance, for it challenged the postulate of scientific interpretation itself. If instinct and intelligence in their cognitive meaning are not degrees of consciousness of external reality evolved concomitantly with the evolution of increasingly complex neural mechanisms, if, on the other hand, they are different in kind, even opposite in their nature, contrary modes of responding to stimulus, then how are we to resist the conclusion that the intellect in man is a human mode, relative to the human organization? While it is comparatively easy to make out a kinship both of instinct and intelligence when we consider only animals which approach the human in the type of their organization, as soon as we turn to consider the perfectibility of instinct in the invertebrata and in plants, the analogy breaks down; the type of mentality is as different as is the type of structural organization.

The theory of evolution arose and established itself as part of the general conception of the positivity of science. The condition of this positivity, its postulate,

is that reason itself cannot be called in question. As matter of fact, until evolution itself raised the problem, the possibility of calling it in question, or the form in which it could be questioned, had never occurred. It had been universally accepted that whatever might be the problems of philosophy concerning the rational nature of man and the presence or absence of reason in other living creatures, reason itself was one and identical whether it was exercised by God or by the meanest of created things. The difference was in degree. There was a fundamental distinction between thought and existence. There might be infinite degrees in the adequacy of thought to represent existence, but the nature of each was absolute. The positivity of science depended on this postulate.

It will be asked, no doubt, why, when the intellect itself is made the subject of scientific inquiry, the question of its origin and evolutionary history cannot remain, what in its first intention it is, a purely scientific matter? Why must it raise a metaphysical issue? The reply is that biology and psychology cannot either avoid the inquiry into the nature and genesis of the intellect, or pursue it, without challenging the postulate on which their own status as sciences rests. We pass of necessity to metaphysics. How can we make knowing itself the subject of our science, inquire into its nature, its origin and its purpose, save in reference to a reality which comprehends it? How can a comprehending reality lie within the abstract domain of apprehended science?

Let us take an illustration. We see an ant laboriously pursuing its task. We have no difficulty in imagining the disproportion of the objects of its conscious activity as compared with the objects of ours.

We suppose the adjustment is simple. A pebble to the ant, we say, must be as a boulder to us, a stem of grass as a forest tree. Yet notwithstanding the disproportion, we suppose ant and man are acting, each in its own way and according to the dictates of its own interest, in a universe common to both. What underlies the conception is the inclusion of ant and man as themselves objects in the world which is the domain of our scientific investigation. But a world in which ant and man are objects of a contemplating mind is not a common world of ant and man. Such a world would be one which presented identical, or at any rate identifiable, features to ant-mind and man-mind. Is there any such world? We cannot say with assurance that there is not, because we cannot know whether, if we passed to the ant-world and viewed it with the ant-mind, we could or could not establish point-to-point correspondences with our man-world seen with our man-mind, but the improbability of such correspondence is so great that it amounts to practical certainty that there is no common world. The affirmation of a world common to ant-mind and man-mind implies two assumptions: first, that the objective reality in each experience is fundamentally identical, and indifferent to the subject of experience; and second, that the mentality of each, however wide the divergences, has correlative factors. In the nature of the case neither of the assumptions can adduce any scientific facts to decide whether it is justified or not. Whatever view we take it is clear that our science has driven us to philosophy and raised of itself an urgent question which is essentially metaphysical.

Let us now look at the scientific importance of the

problem. Suppose that our study of the origin of species has convinced us of the insufficiency of the mechanistic principle of natural selection by elimination of the unfit, and that we feel the need of supplementing it by the principle of a creative force behind evolution, which for want of definite knowledge we may describe as a life force, then we get an entirely new conception. The emphasis now attaches to function and not to structure; structure becomes wholly subordinate to function. Mind as much as body, mind even more than body, is the substantial basis of evolution. Every new species which emerges registers a new mode of activity, and a new range of living action. From this standpoint what evolution has brought forth in man is not primarily a new disposition of material which in some inexplicable way and for some inexplicable reason has acquired the power to enjoy a vision of theoretical truth by passive contemplation of its environment, but an intellectual mode of activity to which structure and mechanism is subservient. Our science is now orientated in a new direction. It is humanized. This does not merely mean that all our conceptions of nature are anthropomorphic. This, if true, is comparatively unimportant. What is important is the discovery that the dichotomy of nature and mind, regarding one as objective reality, the other as ideal representation, which science started by postulating, is unworkable. The evolution of species has turned out to be, not a one-sided transformism of material structure, but a transformism in which mind and nature (our richer concepts of the Cartesian abstract substances, thought and extension) are interdependent factors. We have found, in fact, that biology and psychology, the empirical sciences of

life and mind, are only to be rationalized by a philosophy of the organism.

It may be said, however, that biology and psychology are in their nature closely related to philosophy because life and mind are the objects of these sciences. It is not surprising, therefore, if a purely empirical method in those sciences finds some difficulty in defending the postulate on which all experimental method is based, the postulate that the object of knowledge is indifferent to the ideas which constitute knowledge of the object. No such difficulty, it will be said, can occur in physics, for physics deals only with non-living matter and mechanical movement. Yet, as matter of fact, it is in the physical sciences that the development of theory has raised metaphysical problems and compelled a revision of scientific postulates in a most striking way.

Were one of the great mathematicians of the seventeenth century, well versed in the problems which exercised Descartes and Newton, able to return to our world and to read a modern treatise on physics, what would astonish him probably beyond any idea he would receive of the progress of discovery would be the confidence of accuracy and precision with which figures representing integrals and infinitesimals, surpassing to an unimaginable degree the limits of sense-apprehension, are manipulated. The Ångström unit used for expressing wave-lengths of light is the one hundred millionth of a centimetre. A light year, that is, the distance light would travel in empty space in a year, is more than 63,000 times the distance of the earth from the sun. The modern physicist employs these units as easily as an architect uses a foot-rule. The reason is that the spectroscope has enlarged our range of

investigation at the same time that it has revolutionized our conception of the physical constitution of the material world. It is only relatively that Ångström units are infinitesimal quantities; to the physicist they are definite and constant. In consequence of this extended range modern physics manipulates experimentally velocities which, compared to those of ordinary sensible experience, are, however intelligible, entirely unimaginable. These velocities are all in the neighbourhood of the velocity of the propagation of light and in some way connected with the phenomena of this propagation. The reason is that the spectroscope has given us the means of analysing light, and so enabling us to form a conceptual scheme of its nature and origin. It reveals to us the structure and constitution of the celestial bodies and, equally, the systematic arrangement of the terrestrial elements. The atomic system of modern physics is the scheme of this arrangement. It is a conceptual construction, but in no sense a metaphysical speculation. It is an interpretation of phenomena which can be tested experimentally, and is confirmed by the fact that processes so dissimilar as those of the sciences of physics and chemistry yield identical results.

To understand the metaphysical problem which the electro-magnetic theory of light raises, a brief indication of the essential points of the theory itself is necessary. The simplest way of presenting it without the mathematical formulae is to begin with the phenomenon of the spectrum. The spectrum is the coloured band which appears when a beam of light is passed through the diffracting prism of the spectroscope. It was noticed as soon as this familiar phenomenon was scientifically studied that the spectrum contains char-

acteristic bands and markings, and these were found to indicate the presence in or absence from the incandescent origin of the beam of the different known chemical elements. There is no need to attempt to sketch the extraordinarily rapid development of the science once it had determined its direction. It was soon discovered that the spectrum extends far beyond the band of colour presented to unaided vision, and by various contrivances the invisible spectrum has been more and more completely brought to view. So successful has the science been that it has been possible from the appearance of the spectrum to indicate missing elements, and in nearly every case these, when sought for, have been found.

It was known in the seventeenth century that light has a velocity of propagation, but it was impossible to decide definitely what the nature of light was, whether, for instance, it was corpuscular or in any other sense material. The study of the spectrum confirmed the wave theory, and the bands in the spectrum are easily accounted for on that theory as the definite variations in the frequency of the waves. The clear association of the markings in the spectrum with the chemical nature of the incandescent source pointed to the origin of the waves in the atoms. Following this clue, the new theory of atomic structure has been conceptually constituted, and the periodic table of the ninety known chemical elements arranged. The atoms of the new electro-magnetic theory are not, like the atoms of the old philosophy, solid bits of impenetrable stuff; they are electrical structures, systems of movement in which positive charges of electricity represented by a nucleus, and negative charges represented by electrons rotating in orbits

round the nucleus, are held together in a stable equilibrium. While the atom is in stable equilibrium it is electrically neutral; when the equilibrium is disturbed there is a discharge of electric energy. The actual structure of these atomic systems is at the present time the subject of intensive investigation, and there are rival theories. The broad fact, which alone concerns us here, is that science has established the fundamental physical phenomenon of the universe to be the energy dispersion we know familiarly as light; that the ultimate source of light, whether its immediate origin be the noonday splendour of the sun, the twinkle of the star, which may be a thousand light years distant, or the lucifer match struck in the dark room, is the emission of a quantum of energy which is occasioned by the disturbance of the stability of the electrically constituted atom, such as, for instance, when an electron, by reason of collision or of an electrical attraction or repulsion, is driven out of its orbit. One other thing may be mentioned in order to give completeness to this simple indication of the nature of the new theory. The light to which our retina is sensitive is the light which arises from the disturbance of the electrons in the outer orbits of the atoms. When, as in X-ray radiation, we have energy propagated from the inner and more stable orbits, it has a penetrative power which may work havoc or destruction on sensitive surfaces. It will be seen, therefore, that the modern physical theory is a conceptual scheme framed by following out ordinary mechanical principles in the interpretation of familiar phenomena, and the whole science, though conceptual in the sense that it can only be presented in mathematical formulae to the intellect, and not in objective

material to sense apprehension, is experimental and inductive and positive in its method from its start to its goal. Indeed, no more striking illustration of the strength and sureness of pure scientific method, and no more signal instance of its triumph, could be cited than that which has led stage by stage to the masterpiece of generalization which we know as the electrical theory of matter.

Let us now see how physics, without for a moment turning aside from its own proper interests, and faithful to the experimental method, by the very compelling force of that method, finds itself brought up against metaphysical problems. "Physics beware metaphysics" has proved an impossible maxim, has threatened to be a suicidal maxim. The principle of relativity has revolutionized science by reforming the fundamental concept on which the positivity of physics as an objective science is based. Science must have postulates. Without them advance would be impossible; we could never begin. Think how stultifying scientific procedure would be were every investigator, before devising his experiments, bound to come to terms with Hume's sceptical inquiry concerning the concept of a necessary connexion between a cause and an effect! Science proceeds on its way, leaving that question to the philosophers.

A natural and necessary postulate of science is uniformity. If we have reason to believe that a certain principle is true, we mean by the truth of the principle that it is universal, and by this we mean that it is not affected by quantity or degree. Of course, a principle may be true for a mean quantity and become modifiable in its application when the quantity is very large or very small, but we always assume that

in such case the actual principle itself is unaffected, and that the modification is to be accounted for by the intervention of other factors.

For two centuries following Roemer's discovery of the velocity of light it was not found possible to make use of the discovery in any physical experiments based on terrestrial phenomena. The velocity so enormously exceeded any velocity realizable in human experience of movement that, so far as science was concerned, the discovery only meant that there was a new factor to take into account in making astronomical calculations. There was no reason whatever to suppose that there was any peculiar character about the velocity of light, and that there might not be on Newton's principle an infinitely greater velocity. With the advance of optical science in the nineteenth century, and the perfecting of mathematical instruments of precision, it became possible to make the velocity the subject of actual physical experiments. Then began that long series of attempts to discover the absolute movement of the earth in space, or in the ether supposed to occupy space, by instruments designed to discover the alteration in the velocity of light propagation when the velocity of the moving earth was added to it or subtracted from it. The velocity of the earth's movement in its orbit is in the neighbourhood of one three-thousandth part of the velocity of light, but this was enough to produce an effect which the mathematical measuring instruments would infallibly record. All experiments gave uniformly negative results, and, in consequence, physicists, without abandoning the ground of experimental science, found themselves faced with a problem of metaphysics. The experimental facts were plain

and unambiguous. They proved that the velocity of light is constant under all the varying conditions due to the earth's movement, in which it is observed. Physics had to accept the fact, but it was disconcerting, for it directly contradicted the principle of an infinite velocity which was part of the accepted conception of the nature of the universe. Like the Copernican theory, it was a new discovery which revolutionized the concept of the world. The velocity of light was proved to be what mathematicians call a critical velocity, one which cannot be exceeded because all additions to it fall within it. The philosophical question of its interpretation cannot be avoided. What sort of world is it in which a finite velocity is critical? Only one answer is possible. Velocity is a ratio between a space interval and a time interval; if this ratio is constant, then it necessarily follows that space and time are variable.

What I am chiefly concerned to make clear is the philosophical significance of the new discovery. It is not a new physical phenomenon or a new interpretation of a familiar phenomenon which has necessitated the formulation of the principle of relativity, it is the discovery of an epistemological condition which must apply universally to our knowledge of the physical world. This is why it is more fundamental than the Copernican discovery and even enables us to interpret that discovery. The Copernican theory affirmed that the earth is rotating diurnally and moving along an orbit annually, but it did not and could not change theory into fact, it could not make the earth's movement an actually sensed experience immediately evident. No one can feel the earth move. We know it moves by an intellectual interpretation of our sense-percep-

tions. Now we have made a further discovery. We have found that the earth's movement has no effect whatever on the phenomena of nature which we observe. No terrestrial experiments will reveal to us that the earth is itself moving. The effects of the earth's movement on physical observations and experiments are somehow cancelled. There is somewhere a compensating factor. It is true indeed that there is an experiment, Foucault's pendulum, which shows an effect which agrees with the earth's rotation, which might even be interpreted as demonstrating it, and it is possible that some day we may devise a means of showing an effect of the earth's translation, but should this happen it would not alter the significance of the discovery that the earth's movement does not reveal itself by its effect on the observation of physical phenomena. It is a negative discovery but it yields a positive result. It informs us that our knowledge of the physical universe depends primarily, not on what is presented to us externally, but on an active co-ordination by us of a space-time continuum, and that the fundamental condition of this co-ordination is the immobilization of a system of reference. It goes, therefore, to the very basis of our knowledge of reality and of the nature of the reality we know. It shows us why we cannot feel the earth's movement. The essential condition for an earth-dweller who would use a measuring-rod or a clock is that for him the earth is at rest.

The principle of relativity is the work of Einstein. I am only concerned here to point out its metaphysical character. It illustrates, in a more remarkable manner than any other scientific generalization, the futility and absurdity of setting up physical science as a

domain with natural frontiers, enjoying the peculiar security of an absolute objectivity. That nature presents to the observing mind the aspect of independent objective existence is our common experience, but science is not compelled to assume that nature exists in itself as it appears to the mind. It may make such an assumption provisionally, but to make it dogmatically as a condition of science is to be unscientific in the highest degree. The great philosophical problem how and why nature comes to assume an aspect of independent existence, which the fact of knowledge itself makes inconceivable, is seen in the principle of relativity to be a direct problem of physical science itself.

The principle of relativity does not reject either the positivity of physical science or the objective reality of the universe. It interprets both in an entirely new way, and one which reverses the principle which has ruled since Newton. The common-sense view is that there exists absolutely an external independent reality quite indifferent to whether it exists ideally in any mind; that this reality is revealed to us in sense-perception; that while all our ideas of nature are personal to ourselves, and depend on the particular angle from which we survey it, nature itself is absolute, and knowledge is true about it, the more adequately our idea represents it as it is. This is the ordinary view; we may sum it up as the belief that nature is an absolute system to which all observers of it refer their experience.

Einstein's view, on the contrary, is that the physical universe to which all observers of natural phenomena refer their experience is not a revelation to sense-perception, but a necessary consequence of the intercommuni-

cation of observers. Reduced to its simplest terms, it is that the physical universe consists of moving material systems relative to one another, and not referable to an absolute immobile framework, the space and time of Newton's universe. The condition of observing in such a universe, of measuring its phenomena and determining its events, is that the observer take the system which he chooses, and to which he thereby becomes attached, as a system at rest. That is, all his measurements take the velocity of his own system as zero. While, therefore, according to the old view nature itself provided the observer with an absolute, according to the new view each observer provides in the conditions of observation his own absolute. Every observer has consequently a subjective standpoint, and yet an objective concept arises. On Einstein's principle the objective concept arises in this way. The system of movement which the observer chooses, that is, the system which for his standpoint is immobile, is a frame of reference within which the co-ordinates he uses to measure movements and determine velocities —the three spatial dimensions, length, breadth, depth, and the time dimension—are uniformly interchangeable. That is to say, in order to be quite explicit, his foot-rule will measure for him the same distance along any spatial axis, and his clock will mark the same interval of time. To an observer in another frame of reference for whom the first observer was in a moving system, the foot-rule would not measure equal lengths in every direction or the clock measure uniform time intervals. If, for example, the second system were moving uniformly and rectilineally relatively to the first, the discordance would be in the length axis. If one system were rotating or moving in a spiral or had

any other complex movement relatively to the other, there would be no uniformity along any direction. On one condition only could there be uniformity in the observations taken from such different standpoints, namely, that in exchanging signals of communication the signals should automatically undergo transformation in passing from one system to the other. This is a condition very difficult to realize conceptually. It is important, therefore, to grasp at once the essential point. It is obvious the transformation cannot be physical—no man can by thinking add a cubit to his stature,—it can only be mathematical. Measurements will only preserve the same form for different systems of reference if there can be equations which are invariant for all systems. This is a question for mathematicians. The principle, however, is in no doubt whatever. It is not the universe directly revealed in sense-perception which provides the subject-matter for mathematics. Mathematics is original. Mathematics arises in the need of the subject of experience to co-ordinate his universe. Mathematics, therefore, creates the subject-matter of physics, and not vice versa. The real universe is my universe and yours. There is no universe which is neither yours nor mine nor any one's. If we indulge in speculation and fancy for ourselves the existence of such a universe, even if we succeed in being logically consistent in our creation, it will be a dream-world on which science will have no hold. Thus science has brought us to philosophy.

It is interesting also to look at the lesson of history. Modern philosophy arose in the seventeenth century. It did not arise out of an opposition between a philosophical method of speculation and a scientific

method of experiment. It is sometimes suggested that this opposition can be traced back to a distinction between the method of Galileo and that of Descartes. It is a false notion. Descartes and indeed all the philosophers in France and Italy in the seventeenth century were primarily mathematicians. The difference between the speculations of Galileo and those of Descartes was the emphasis in the one case on physics, in the other on mathematics. We look in vain for any distinction between philosophy and science in the seventeenth century. It was in the eighteenth century, with the rise of the English empirical philosophy, that philosophy came to be regarded as a special problem of psychology and epistemology. It was this new subject-matter which turned philosophy and physical science into divergent paths. The development of the English empirical philosophy into scepticism still further alienated science. Philosophy became more and more engrossed in the problem how science is possible, although at the very time the sciences themselves were widening out and conquering new domains. It is little wonder that the leaders of science were impatient with what could not appear to them other than pedantic and in any case futile controversies. In the nineteenth century the divergence became not only an opposition but a conflict. A new ideal possessed physical science, the ideal of itself providing the philosophy of the future. This philosophy of science was conceived dogmatically. Metaphysics was relegated with theology to the limbo of outworn creeds and discredited intellectual figments. Science proclaimed its positivity. It claimed to touch the absolute. Its principle seemed sure and an infinite vista of orderly extension lay open before it. Its

work, it declared, was not to speculate on origins or on final ends, but to accept the actual, to tidy up, to reduce all disordered and chaotic life and knowledge to orderly arrangement. To-day we know that this ideal has not been and cannot be realized. Philosophy is necessary to science and science cannot provide it from itself. The continual advance of scientific invention and consequent discovery has raised metaphysical problems in science and compelled us to reconsider and reconstruct the basis of science itself. The new principle of relativity is the recognition that the facts observed cannot be understood in their purely objective existence without taking into account, not only the objective conditions of observation, but also the subjective conditions of the observer's mind in observing. The leaders in the scientific revolution are men of science who have not been dismayed when they have found their discoveries leading them to philosophy.

II

THE NEW IDEALISM

An Inaugural Address at King's College, London, on May 16, 1918.

When a newly appointed professor of philosophy is asked to give his inaugural address, he is not in quite the same position as a professor of chemistry, physics, biology or mathematics, for these subjects are sufficiently definite: a philosopher must indicate what his philosophy is. I have, therefore, in describing what I hold to be the important direction in which philosophical thought is moving, to make a confession of my own faith, to express what I myself hold to be the task, the subject-matter and the special method, of philosophy. Not only is there great lack of agreement among philosophers, but also philosophy does in an especial manner, which science does not, take its objective character from the subjective personality of the philosopher who professes it. This is commonly urged against philosophy as a reproach, but, so far from being a just ground of reproach, it is, in my view, that which in a high degree gives distinction to philosophy and marks the special nature of its problem and method.

There is, however, a reproach from which philosophers have suffered, and from which we all suffer to-day. I should like, at the outset, to examine into

its nature and cause, because the bringing it into clear relief will, I think, enable us to see the direction in which the modern world is now seeking the guidance of philosophy. The reproach is a twofold one, or rather it touches two antithetical aspects of the studies which engage philosophers. Either we are concerned about fundamental assumptions, and then we seem to devote enormous labour to the discovery of a logical proof of what the ordinary man accepts as easy, simple and obvious, and we are reproached, by the man of science quite as often as by the plain practical man, with triviality; or else we are concerned about ultimate concepts, the great problems of the end or purpose of the world, the problems of the soul, the universe, God, and then we are reproached, by the believer in religion quite as often as by the worker in science, with aloofness; our concepts seem remote from every interest, practical or religious. This double reproach always has been felt and expressed against philosophy. In Molière's witty and profoundly philosophical comedy, *Don Juan, ou Le Festin de pierre*, there is a scene in which the contrast between philosophic wisdom and shrewd common sense is artistically portrayed with inimitable humour. Don Juan and his servant Sganarelle are in flight; they are passing through a forest in disguise, Don Juan in ordinary country attire, Sganarelle in the robe of a travelling apothecary. The timid, craven, superstitious and, at the same time, exceedingly shrewd serving-man, alarmed at every sound, in terror and afraid to fall a step behind his master, is keeping up his courage by availing himself of the licence given him to discourse and argue on high matters. He questions Don Juan on his disbelief in all those conventions which seem

to the men of ordinary common sense so firmly grounded, and at last, tired of discovering only negations, he asks his master what belief he does hold to be certain. Don Juan replies, " Je crois que deux et deux sont quatre, Sganarelle, et que quatre et quatre sont huit." In his rejoinder Sganarelle utters the sage reflection that " pour avoir bien étudié, on est bien moins sage le plus souvent." When we recollect that this comedy was written in the latter half of the seventeenth century, at the time when the whole learned world was possessed with enthusiasm for the new method of Descartes, the principle of universal doubt, it is not difficult to see the intention of the satirist. And the case is not different to-day, save that we are not permitted to accept Don Juan's arithmetic as obvious. Has not Mr. Russell told us that " twice two are four " is not a proposition, because there is no entity " two "; it is a propositional function, and we must not believe it without proving it, and the proof is very long and very complex? This, then, is one reproach. We spend much labour on what is trivial.

On the other hand, our interest in the great problems does not avoid reproach. Every one is familiar with the wonderful description which Plato has given us in the *Phaedo*, of the last hours of Socrates, and his death in the Athenian prison. The ship has returned from Delos, the death sentence is to be carried out that day, and Socrates has decided to spend his time, to the last, discussing with his friends the great problems—the soul, its origin and destiny; the individual and the state; desire and duty. " On entering we found Socrates just released from chains, and Xanthippe sitting beside him, and holding his

child in her arms. When she saw us she uttered a cry, and said, as women will: 'O Socrates, this is the last time that either you will converse with your friends or they with you.' Socrates turned to Crito and said: 'Crito, let some one take her home!'" Do not we all, as we read those words, in that tale which we can never read without ourselves experiencing the emotion, sympathize with the woman and wonder at the harshness of the philosopher? How remote and aloof from all vital interest, how cold and unreal, at such a time is the greatest intellectual problem compared with the present reality that husband and father are about to die!

The reproach, therefore, concerns something very subtle, something linked up with the very nature of philosophy. Philosophy seems to be a speculative luxury for idle people, having no relation to the urgent practical business of life, or even to the theoretical interests of scientific reality. It may bring both pleasure and profit as mental discipline, just as gymnastic does in bodily training, but, so far as intrinsic value is concerned, it is outside the circle of the true humanities. Let us take modern instances. Who has read the delightfully lucid account by Mr. Russell of the *Problems of Philosophy*, in the Home University Library series, without a feeling of surprise mixed with resentment that so many trivial and even foolish questions should be raised to the dignity of philosophy? Who, again, has read the brilliant dialectical argument of Mr. Bradley in *Appearance and Reality* without a distinct feeling of disappointment at finding the concept of the Absolute so remote from any relation to the warm, living reality of our actual experience?

It seems, therefore, to the ordinary man, and more

especially to the worker in natural science, that philosophy delimits a sphere which it leaves to men of affairs and to scientific research, while it concerns itself only with the vague, void, unpractical notions which lie outside, above and below that sphere. Science becomes the realm of sure knowledge, philosophy mere speculation concerning a beyond. There can be no doubt that the older idealisms are largely responsible for this reproach, and one underlying motive in the new realism is the desire to make philosophy scientific in the technical meaning of the term. The new idealism of which I wish to speak is the view of those who hold that philosophy is wholly concerned with the actual world of experience, and not, directly or indirectly, with a transcendental world: but who hold, at the same time, that there is a method of philosophy which may include, but certainly does not aspire to as its ideal, and is not identical with, the method of science.

There are some, however, whose attitude towards philosophy is one of disappointment rather than reproach, and this disappointment is not confined to any class of persons. I refer to those eager inquirers who long to pierce the barrier of our human limitations and obtain some glimpse of the conditions which they think may be the real determining factors of existence. Scientific workers in particular, conscious, as they cannot but be, of the relative nature of scientific knowledge, are prone to regard philosophy as a science of the unconditioned, or at least as offering a prospect of transcending material conditions. To them philosophy is the attraction of a sort of romantic escape. There are many considerations which tempt us to indulge our fancy, and the temptations are often

yielded to by philosophers themselves, fully conscious as they are that romantic speculation is no part of the philosopher's task. We observe that forms of psychical life which lie open to our inspection are limited in their range in ways which make it impossible that the creatures themselves should attain to consciousness of their limitations, that they should know themselves as we know them, or suspect the uses to which we submit them. These observations lead us to wonder whether we are not ourselves subject to similar limitations, and perhaps serving alien purposes the nature of which, could we even guess them, might clear up many mysteries. Shadworth Hodgson, a philosopher who died a few years ago, and who had no insignificant place in the intellectual life of London in the latter part of the nineteenth century, though in his philosophy so earnest and so restrained, was yet often tempted, both in his writing and in conversation, to indulge this craving to guess at romantic possibilities. Sometimes it took extravagant form, as when, in the beginning of his chief work, *The Metaphysic of Experience*, he suggested the possibility that this whole material universe, which seems to us so absolute, may exist in the flower in the buttonhole of some Micromegas taking his after-dinner nap, to be flung aside when he wakes up. He suggested it only to show that, even had we reason to suspect such a fantastic notion to be true, it would have no relevance to the true quest of philosophy. Yet in very serious mood, at the close of the same work, he sketches a theory, not indeed in the same sense extravagant, but still of a scientifically romantic nature, by which he sought to comfort himself and others with some proof that our hope of reunion with loved ones lost to us is not

dependent only on spiritual aspiration or religious faith, but is in conformity with inexorable scientific laws.

These romantic speculations are, in my view, so far as they are rational, scientific rather than philosophical. There are many men of science to-day, and some of the most eminent, who have embraced, and identified themselves with, the most fantastic speculations of what is named "psychical research." I think it is science, not philosophy, which allures them. I mention it only lest any one should think I have this in mind when I say that the new idealist movement in philosophy is in its origin and principle the consciousness that it is one and the same subject-matter which gives its problems to science and its problems to philosophy.

There can be no doubt in any one's mind who has followed the intellectual development and the progress of research in the present generation that there is to-day a wider interest in philosophy than has ever been evident before in what we may call the modern period. In a large measure it may be due to a natural reaction against the scientific spirit of the nineteenth century, with the apparent complete triumph towards the end of that century of the principle of mechanistic interpretation. It is, in my view, not a reaction at all, but a manifestation of the positive progress and expansion of our intellectual activity. Whatever view we take of the nature and origin of this interest, there remains the fact that it exists, and it is instructive to look back and note the stages of its progress during recent times.

In 1880 the Aristotelian Society was founded in London. To-day it occupies a unique position among learned societies, in the work it does, the world-wide

recognition it has secured for its work, and the inclusion within its membership of philosophers whose theories are more noticeable for their divergence from, than their agreement with, one another. It is and it has been a meeting-place of philosophical views of every school. Yet it has remained true to its original purpose expressed in its full name, the Aristotelian Society for the Systematic Study of Philosophy. Those who founded it were not philosophers, and they were not even students of philosophy in the academical meaning. Had the Society been started at Oxford or at Cambridge, or even had there been at the time a teaching university in London, the event would have had little significance. The young men who formed the Aristotelian Society were not from college class-rooms. The first nucleus consisted of fellow-workers in a chemical laboratory, and they formed the Society for the simple purpose of studying philosophy by discussing its problems and by reading together first-hand the classical works of philosophy. It was a unique thing, and, as we look back on it, a somewhat extraordinary thing. At that time there were many philosophers, and there was the regular philosophical teaching of the universities, but the interest in philosophy, outside the narrowest academical circles, was at its lowest ebb. In fact, to the ordinary man, philosophy could hardly be said to mean what it means to-day. It was the time of Comte and Positivism, of Herbert Spencer and of the popular expounders of evolution theories. I do not mean to deny the claim of Auguste Comte and Herbert Spencer to be regarded as philosophers, but the keynote of their teaching was rejection, and even contempt, of metaphysics, and the exaltation of scientific induction as the one and only

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method in the search for truth. Philosophy for them was little more than a classification of the sciences. It was then that we formed the idea of meeting together frequently to study philosophy, its problems and its historical development, philosophy as it was understood by the great thinkers of the past — Plato and Aristotle; Descartes, Spinoza and Leibniz; Locke, Berkeley and Hume; Kant and Hegel. The year 1881 was the centenary year of the publication of Kant's *Critique of Pure Reason*. The centenary excited little interest even in academical circles, although it was made the occasion of the issue of a new English translation by Professor Max Müller, of Oxford. In America a commemoration meeting was held in celebration of it, and it also called forth from the enthusiastic American Hegelian philosopher, W. T. Harris, a corresponding member of the Aristotelian Society, a special number of his *Journal of Speculative Philosophy*. It was this, I think, which determined us to devote the session of 1881 to the reading and discussion of Kant's great *Critique*. We met fortnightly, and each member took an active part in the work. The following session we studied the *Critique of Practical Reason*, and after that Schopenhauer's *World as Will and Idea*, in the translation which Lord Haldane had just completed. After a time, and as the original members dropped off, the character of our studies altered. Mr. Shadworth Hodgson was our president, and many of the recognized professors of philosophy now joined us, among the earliest of whom I may name William James, Alexander Bain, Bernard Bosanquet, D. G. Ritchie, Thomas Davidson, G. H. Romanes and Johnstone Stoney. The encouragement and discussion of original work has given

place to the old systematic study of classical works, but what the Aristotelian Society has done and is doing, or rather I would say what the Aristotelian Society stands for, is the expression of philosophy as a wide human interest and its free and open and unrestrained discussion. No movement in philosophy is without its reflection in the symposia and papers published in its *Proceedings*.

Certain notable philosophical events stand out to me as marking the stages and showing the direction of the modern mind in this new philosophical interest. The first of these is Mr. F. H. Bradley's *Appearance and Reality*, a work to which I have already alluded. This book appeared in 1893, and at once seemed to interest a much wider circle than those to whom technical treatises on Logic and Metaphysic are ordinarily addressed. The effect of that book, as I recall my first impression of it, was magical. Its skilful dialectic reminded one of the old paradoxes of Zeno of Elea, and at times seemed to rival their picturesque presentment. By the opposition it aroused, quite as much as by the lead which it gave to the intellectualist doctrine in its masterly exposition of degrees of reality, it has become an integral part of the philosophical expression of our age. It stood out in the first few years after its publication as a new and triumphant vindication of idealist theory and method. It did not remain long unchallenged.

A few years later the mathematical philosophy of Mr. Bertrand Russell, associated in its philosophical theory with the work of Dr. G E. Moore, and in its mathematical theory with Dr. A. N. Whitehead, began to be discussed. It was as uncompromisingly intellectualistic as the work of Mr. Bradley, at the

same time that it was widely divergent in its tendency. It pointed to a new realism. Mr. Russell now names his theory "logical atomism." Its main thesis and its directing principle were that mathematics is founded on logic, and that the problem of philosophy is to discover and reveal the logical processes underlying mathematical beliefs. It was too difficult to be popular even in the limited sense in which philosophical theories enjoy popularity. I am speaking of Mr. Russell's older work, represented by the *Principles of Mathematics*; the *Essays* belong of course to the present day. This philosophy seemed, however, to have one positive result which justified its claim to be ranked as a progressive science. It cleared up for us the concept of infinity. Hitherto infinity had presented itself to the mind as almost synonymous with self-contradiction. It seemed to lie at the root of all the antinomies and to furnish the basis of an ultimate scepticism as to the power of the intellect to attain truth. The new theory, however little it may have affected the psychological difficulty, has at least been successful in clearing away the logical contradiction supposed to be inherent in the concept.

A more direct challenge to Mr. Bradley's metaphysics came in the work of William James, and particularly in the series of lectures and articles in which he expounded the theory named Pragmatism. James's own philosophy was critical and destructive rather than constructive; his chief interest, he said, was in "Radical Empiricism," which implies criticism. He, like Mr. Bradley, seemed to reach an audience outside the academical circle, and he stands out to me as marking one of the stages in the advent of the present interest in philosophy.

The philosopher, however, who, in the present day, has aroused the greatest interest and made the profoundest impression on the modern mind is, without any question, Henri Bergson. His popularity both as a lecturer and as a writer has at times seemed to the academic mind almost a scandal. It seems unfitting to the dignity of philosophy that it should appeal to the popular audience, or that fashionable crowds should besiege the doors of the lecture room. Bergson's philosophical work dates from 1888, but his fame came with the publication of *L'Évolution créatrice* in 1907. He never courted fame, it came to him with surprising suddenness, and it has not turned him aside from his work. The war has interrupted it. It is Bergson's philosophy which I have mainly in mind, as the representative philosophy of what I call the new idealist movement. I do not mean that Bergson is an idealist philosopher in the old sense of the term. He is anti-intellectualist, he brings theory of life to the interpretation of intellect, and sees in intellect only an instrument of life. I call his philosophy new because it recognizes that present reality, or duration, is the subject-matter of philosophy, and not the conditions which transcend duration; and because it recognizes that the problems of philosophy are one and identical with the problems of science. I call it idealist because it insists that the method of philosophy is distinct from the method of science. Philosophy begins with an intellectual effort which reverses the scientific method, an effort to apprehend the whole before scientific analysis, in an intuition.

What appears to me to be the secret of the great hold which Bergson's philosophy has taken on the modern mind is its direct challenge of some of the

most generally accepted hypotheses of natural science, in particular those which concern the origin and evolution of life. It was a new phenomenon for philosophy to challenge the actual inductions of science. Philosophy was expected to accept these, or at least observe in regard to them a benevolent neutrality. But Bergson challenged the evolution theories of biological science, and brought philosophical criticism to bear not merely on their basis and principle but on the alleged facts themselves. During the last few years scientific theory has made notable advance, and in many departments startling developments have revolutionized the old concepts. Meanwhile, from philosophy have come theories of time and space, theories of life and matter, theories of mind and brain, theories of instinct and intelligence, theories of evolution, all which touch at every vital point the working hypotheses of science.

There is one other philosopher, whose voice is just beginning to reach us, who also represents this new idealist movement in philosophy, the Italian philosopher Benedetto Croce. In his case the term " new idealist " would be unequivocal, for all reality is in his philosophy the activity of mind, but it is an activity immanent in the actual historical present. For him as for Bergson philosophy comes down from the transcendental sphere.

It will be seen that the new idealist movement I have in mind is represented by two philosophers, one in France, the other in Italy. On the other hand, in America there is a strong philosophical movement in the direction of a new realism. It is to me one of the most striking features of the philosophical development since the scholastic period ended, and the modern period began with Descartes, that the movements of

thought have assumed a national character. It is familiar, of course, to all students of the history of philosophy. We have the French, the English, the Scottish, the German development, each with its marked characteristics, and seldom contemporaneous. It was noticeable even before the war how the leading in philosophy had departed from Germany. To-day there are two vigorous movements; one seems to take its character from the new world, the other from the Latin countries of the old world.

This brief reference to some of the movements which have marked the trend of the philosophical development of the contemporary period may also serve to indicate the strikingly antithetical nature of the activity of philosophical thought. We seem to advance by emphasizing now one aspect, now another, of the great problem. To-day we have this antithesis in the new realism and the new idealism. It is outside my purpose to attempt an appreciation or criticism of the new realism, certainly I do not wish to pass judgment upon it. I want rather to indicate what seem to me the guiding principles of the other tendency. I may, however, best indicate these by pointing out what seems to me to be the principal contrast. It is a contrast of method. The new realism derives its characteristic feature from an absolute confidence in scientific method, and the ideal, therefore, which seems to inspire it is the extension of that method so that it shall embrace not only the body of physical science but the fundamental concepts, mathematical and logical, on which physical science rests. Occam's razor is its instrument, the final elimination of all difference its goal. It holds firmly to the scientific postulate that knowing is an act of discerning and that "ideal"

construction is not " real " construction, nature is not the work of mind. The new idealism, on the other hand, is the insistence on the inadequacy of scientific method in philosophy. The ground of this inadequacy is the dependent and relative nature of physical science itself. It is relative to the practical nature of intellectual knowledge. In the doctrine of one representative, Bergson, the intellect is a form of mind, contrived and perfected in the course of creative evolution to adapt the mind to a special mode of knowing, a mode which is determined by, at the same time that it is a determinant of, the practical activity of the creature. Moreover, it is not the only mode, and it leaves out of account instinct or intuition. According to another representative, Croce, the mathematical sciences by their abstractness, the physical sciences by their empirical character, are marked out as dependent spheres of knowledge. They belong to the economic activity of mind, and the full life of mind is aesthetic and logical and economic and ethical. To both these philosophers, therefore, it is inconceivable, because incompatible with the nature of life, that any mere extension of scientific method should be able to embrace the whole of life.

The method of philosophy, as the idealist conceives it, is to study the concrete and not the abstract. It is to grasp the whole immediately in the individuality of its process or organic activity. It is a method which distinguishes moments or degrees of a self-developing manifestation, but without losing hold of the concrete and without seeking to rival the precision which the mathematical sciences attain by abstractness alone. The precision philosophy strives for is concrete and historical, not abstract and mathematical.

In the philosophy of Bergson this concrete reality is conceived as life, the same phenomenon "life" which the biologist studies. Life is not for philosophy a different concept from that of science. It is not the concept of a transcendent, unconditioned principle, brought from some supra-mundane sphere to conform to some ideal interpretation of reality. It is the immanent principle in the immediate fact which every individual experient expresses when he uses the terms "here" and "now."

In the philosophy of Croce the concrete reality is mind. This "mind" which philosophy studies as all-inclusive reality is not an "absolute" beyond experience, but one and identical with the "mind" which the historian studies, with the history which constitutes present, living, fact.

There is, therefore, in the new idealism a convergence rather than a divergence between the philosophical and the scientific standpoints, also a more or less conscious recognition that the problems of science are identical with the problems of philosophy. We are, whether workers in philosophy or in science, dealing with the same reality, and subject to the same limitations, and searching for the same ultimate truth, though differing in our standpoint and defending our own methods, and the consciousness of this identity constitutes the chief difference between the new idealism and the old.

Our claim then as new idealists is that we have given up the vague and indefinite notions as well as the outworn expressions of the older metaphysical and transcendental systems, and are striving to understand the reality of particular concrete fact. The new awakening is not confined to philosophy, it is clearly evident in

science, and in every department of science. Everywhere we find a dissatisfaction with working hypotheses, and a particular suspicion of hypotheses when they have come to be accepted as fundamental principles. It is this new consciousness which is bringing together those who are working by objective methods in the laboratory and those who approach the problems from the side of the study of mind and its activity.

I will illustrate my meaning by reference to one of the most famous of recent scientific experiments in order to show the identity of the problem which gave rise to the experiment with an old philosophical problem. I refer to the well-known Michelson-Morley experiment, contrived to detect a variation in the velocity of the propagation of light due to the translation of the system within which the light has its source. The unexpected negative result of this experiment has had far-reaching, even revolutionary, consequences, necessitating a reconsideration of the fundamental bases of physical theory, and the formulation of the principle of relativity. To understand the nature of this problem I will ask you first to consider and compare with it a classical problem of philosophy.

Every one is familiar with the conclusion which Kant reached in the *Critique of Pure Reason*, as a result of his inquiry into the conditions which make experience possible, and the theory of knowledge which he founded thereon. Pure reason gives us three Ideas—God, Freedom and Immortality—but these ideas are not cognitions. The mind thinks them objectively as three objects, and would make each the subject-matter of a rational science. It would make the Soul the subject-matter of a Rational Psychology, the World the subject-matter of a Rational Cosmology, and God

the subject-matter of a Rational Theology. But there are no such sciences because we have no speculative or theoretical knowledge of such objects, and such knowledge is not merely unattainable, it is in the nature of the case impossible. The argument is not easy to appreciate, and I think few people really understand it. Why is it impossible for us to suppose that these three Ideas may have corresponding existing objects, and that our ideas may be cognitions of such objects? Or why indeed may they not be cognitions, even though they be wholly ideal and concern objects which are non-existent?

Many objects of which we may have cognition may not exist, as, for instance, the hundred dollars of Kant's famous illustration which he compared with the existing hundred dollars in the pocket. And indeed, as we know, Kant did hold that we must *believe* in the existence of objects corresponding to these Ideas; only he maintained that the belief was grounded on practical, not theoretical knowledge. What did he mean then by maintaining that theoretical knowledge of the Ideas is impossible? It does not seem to follow from any of the general conclusions of his philosophy. We may accept or not the phenomenal theory; we may agree or not that we have no knowledge of things in themselves; but the Ideas of reason are not things in themselves in contradistinction from the objects we can know. The distinction of phenomenon and noumenon applies to every object of knowledge, to tables and chairs, to ourselves and other people, to the other side of the moon, to Chimaeras and Greek deities. Indeed, if the Ideas of Reason were things in themselves we might know them, although we should know them only as phenomena, not as they are in themselves. We

come nearer to Kant's meaning in his argument that they are ideas of the unconditioned and that knowledge of the unconditioned is a contradiction in terms. In that case the difficulty Kant was thinking of would appear to be that an apprehending act of thinking, which should endeavour to include within the unity of its apprehending act the whole set of the conditions of experience, would have to include itself and its own act among the conditions. Such inclusion may be easily seen to be impossible and self-contradictory. This may come near to Kant's way of expressing his argument, but when we delve beneath it and try to discover what was the problem which confronted him, we see that it was something very profound, and independent of the particular way in which he reached it. Indeed, the argument is good to-day, whatever view we take of Kant's artificial analysis of the a priori conditions of experience. It is an argument which is valid against every transcendental philosophy.

Kant saw very clearly (he had learnt it from Leibniz) that the subject of experience, the knower, is within the system of his experience and himself the centre of the system, and that all he has to guide him or to inform him of what is without that system are the rules by which he works within. The subject may distinguish, therefore, within his experience, sense and understanding, image and concept, matter and form, particular and universal, thought and thing, but when he would distinguish experience itself from what is not experience, what is not even the condition of experience, but the absolute set of the conditions and their absolute relation, he is seeking what in the nature of things it is impossible he should find. He is seeking a standard by which he may measure experience with its forms

of unity, space and time, the categories, and whatever else he may distinguish, on an absolute scale; and there is none. Reason gives us the Ideas, but they prove to be only the Rules of our own procedure. We may then know theoretically objects of thought conceived as existing on a higher plane than ourselves, for example, the God Jehovah or his antithesis Satan if there be such beings to know, but we cannot know theoretically " the Supreme Being."

Now let us turn to the scientific problem and ask what is the real meaning of the negative result of the Michelson-Morley experiment, and the reason why that negative result had such an astonishing effect on scientific theory. It was a revelation. It showed us that observers within a system of reference, in uniform movement of translation relatively to other systems, have no absolute standard by which they can determine their movement. There is no absolute ether, no absolute space and no absolute time, by reference to which we can determine our movements. The experiment was carried out by throwing a beam of light to a mirror and reflecting it to its source, first along and then across the ether stream, and it was anticipated that the difference would appear in an interference line. Had the experiment given the expected result, it would have shown that from phenomena within our system of reference we can determine the relations of the system. The negative result, on the other hand, proved clearly that the standard of measurement had suffered deformation with the deformation of the system. In science as in philosophy we have found so far that we are observers within a system which we can by no means transcend.

If, then, our problems in philosophy and in science

are identical, why are our methods different? The reason is that scientific method fails us in philosophy. It is inadequate, or it falls short. Science is a department within a greater whole. Philosophy not only is concerned with scientific truth but with the truth of science. I shall illustrate my meaning, however, if I apply it to the actual circumstances of this present assembly. When we entered this room we arranged ourselves according to a certain order which we call the order of physical reality. This order of physical reality is conceived as a system of material bodies occupying space, a system of acting and interacting objects. The scientific concept by which we explain this order, and which we consider as universally applicable to it, is the concept of causality. It is based on, and in fact is, the notion of an exact equivalence of actions and reactions, a system of exactly compensating movements. We say that however much the system changes the energy is constant. And this serves us. We may be empiricists or sceptics in regard to the principle itself, but without it there is no scientific explanation and no scientific method. When you entered this room, however, the purpose which had led you to this course of action formed no part of this order of physical reality, and you arranged yourself according to an order of an entirely different nature. Your purpose in coming here was that you might enjoy inter-subjective intercourse. Not only is each of us a physical object in spatial relation to other physical objects, but each of us is a mind. The mental order is totally different from the physical order, and scientific method applied to the mental order fails absolutely. The profoundest insight into the deepest problem of philosophy is afforded us in those well-

known words of Leibniz: "The monads have no windows through which anything could come in or go out." The mind is a monad, it is an all-inclusive and an all-exclusive world. You may feel inclined to dispute it. You will say there is intercourse between one mind and another: can this be unless ideas are conveyed from one mind to another? But there is no interchange in the scientific meaning, and therefore the problem of intercourse is the problem of philosophy. When I succeed in imparting to you an idea of mine, my mind is not the poorer by one idea, yours the richer. Nothing has passed out of my mind into yours, as, for instance, when water is poured out of one vessel into another. The images which arise in your mind, the concepts in which you frame those images, arise within your own mind and are your own private incommunicable possession. It is clear that the physical concept fails us utterly here. Causality in the sense in which we use it universally in science not only fails to be explanatory, but fails to convey any meaning. A method which explains the whole by the part; which assumes the whole to be a complete inventory; which treats relations as mechanical; is useful and necessary in the physical order but cannot serve us in the mental order. We must find a philosophical method. The essence of such method is that it proceeds from the whole to the part, from the concrete to the abstract. It is the reverse of the scientific method. Leibniz described the relation of the monads as a pre-established harmony. Kant declared that knowledge is possible only if its formal and material elements are an a priori synthesis. We may be dissatisfied, we may feel that these are unsolved, perhaps insoluble, difficulties, but what is clear to every one who reflects is that the

relation of mind to mind, or of the subject of knowledge to the object of knowledge, presents facts which are not amenable to scientific method. Moreover, the method of science is comprehended within philosophy, and because it is, it cannot itself be the method of philosophy.

This indicates fairly exactly the relation of philosophy to science as it is presented to us in the doctrines of the two contemporary philosophers whom I have had in mind as the representatives of a new idealist movement, Bergson and Croce. Take, for example, the principle of Bergson. Knowledge, whether we study it in its instinctive mode or in its intelligent mode, assumes its particular form from the practical activity which it has been evolved to serve, and this bias towards practice gives rise to illusion whenever it is used as an end in itself and directed to the attainment of pure speculative truth. Again, take the principle of Croce. The distinction between the real and the unreal, which we seem to possess immediately in external perception, is only to be explained by an activity of mind, and the task of philosophy is to bring to light the stages of this activity. In neither philosopher is there antagonism to science or contempt of scientific method. On the contrary, there is the consciousness that the value of that method is enhanced when its limitation is understood. Nevertheless the method is limited, and limited in such a way that in its very nature it cannot serve in philosophy. This seems to me what most distinctly divides the new idealist movement from the new realist movement. The latter seems to me hypnotized by scientific method, and to some at least of its chief representatives the success or failure of philosophical research is measured

by the extent to which philosophical problems can be made amenable to it.

I will close my address with a practical suggestion which I hope we may set to work at once to realize. It is that *fundamental* scientific questions, such as the new conceptions of matter and energy which are emerging as the result of experimental study of ionized gases, radio-activity, etc., should be discussed directly between philosophers and those who are doing the experimental work. At present we are extraordinarily shy of one another. The scientific workers are inclined to regard the philosophers as dreamers, aloof from any real interest in scientific hypotheses, and, on the other hand, the philosophers are too apt to accept and swallow whole the working hypotheses of particular sciences and not recognize how limited are the set of data from which they are derived. The problems of science and the problems of philosophy are closely allied and interlinked at every point. The search for truth demands a philosophy in close association with physical science.

III

PHILOSOPHY AND HISTORY

EVERY man is a philosopher. It lies in human nature to present to the mind the life we live and the world we live in as objects of contemplation and reflective thought. We suppose, though we may be wrong, that philosophy is peculiar to man, one of the characteristics marking our superiority. The animals are like us in responding to external situations by continual internal adaptation, but in no instance do they seem to have attained the power which we possess, and which accompanies all our intelligent actions—the power of making mind itself an object to itself. Yet though every man is a philosopher, when philosophy takes literary form it seems to shape itself into a realm of knowledge remote from that of daily life. Its problems seem abstract, difficult to comprehend, and useless when comprehended. So it happens that while philosophy is an overpowering interest, the writings of philosophers are to most of us unattractive, and in their abstractness even repellent. This being the fact about philosophy, the first essential thing, if we would know how to read it, is to understand the nature and source of its attraction and repulsion.

The great works of philosophy are literature of

a very high order. The *Republic* and the *Phaedo* of Plato, the *De rerum natura* of Lucretius, Descartes's *Discourse on Method*, Berkeley's *Dialogues between Hylas and Philonous*, Hume's *Essays*, Pascal's *Pensées*, will always be cherished and read. Yes, it may be said, but we read these for the aesthetic satisfaction we derive from their artistic presentation. If we go to them in the interest of pure philosophy, and to obtain definite answers to categorical questions —if we go to them for pure logical satisfaction—the result will be meagre in the extreme. And it is not a question of the method a philosopher adopts, nor of the ideal and scope of his inquiry. If, for example, we follow Mr. Bradley in his attempt to construct the concept of the Absolute, or if we follow Mr. Russell into his mathematically precise investigation of the logical basis of knowledge, the result is the same. The depressing and desolating conclusion is forced upon us that anything we can know with certainty is so infinitely trivial that we are left wondering if it can be worth while to spend so much pains to secure so small a dose of wisdom. Mr. Bradley will tell us that " Metaphysics is the finding of bad reasons for what we believe upon instinct, but to find these reasons is no less an instinct." Mr. Russell will insist that the truth or falsity of such propositional functions as are represented in the nonsensical proposition, " the present King of France is bald," is of serious import, and he will end by telling us that anything, if there be anything, which we can know certainly, will, in becoming known, cease to be philosophy.

Were this the end of the matter, were there no other aspect of the philosophical problem, and no

other use for philosophy, we should have to meet the inquiry how to read philosophy, with Mr. Punch's advice to those about to marry, "Don't." There is, however, another aspect which transforms the whole interest, effects a transvaluation in the concept of philosophy, and is therefore essential to comprehend if we would know how to read philosophy. As a first description we may name it the historical concept of philosophy. In its final form it is the complete identity of the concepts of philosophy and history. The difficulty of presenting it is that it is not only a view of philosophy but itself a philosophy. It involves a reversal of the ordinary notion of reality and knowledge.

Let me first make clear two things which I do not mean when I say that philosophy is history. First, I do not mean that there is a philosophy of history. The concept of a philosophy of history has at times taken powerful hold of the human mind. It has seemed, not only to the uncultured and superstitious, but to many philosophers, including some of the greatest, that the historical development of mankind, that is, the succession of the great events in the order of history, reveals a mind moving towards a purposive goal, analogous to the mind which directs our individual actions. The great historical religions express this concept in the idea of revelation, and are in great measure founded upon it. And, secondly, I do not mean that there is a history of philosophy in the sense that every philosophical doctrine has historical relations. The origin of every system of philosophy must be sought in the ideas which found expression in preceding systems. Also, every system reflects in its character the political, social and

economical conditions of its age. But, important as the history of theories is, the historical character of philosophy does not consist in the place a system occupies in a chronological series.

Turning, then, from what I might be thought to mean, I come to what I actually do mean by the concept of philosophy as history. I mean that the ordinary presentation of philosophy as the riddle of the sphinx, to which theories and systems are so many attempts, all in vain, to give the answer, is an entire misconception. The problem of philosophy is not a fixed, unvarying riddle, with which each age and each thoughtful individual in every age is confronted. Philosophy is historical judgment, because the reality which confronts it is history. Life, if we try to think of it as something distinct from its history, as something which has a history, is an empty abstraction, a nonentity impossible even to conceive. Life is its history. Just as the seeming solid earth, which to common sense is the unchanging sphere of human life and actions, to physical science is a non-rigid equilibrium of active, attractive, and repellent forces, maintained by continual adaptation to the changes due to its translation which disturbs every conceivable constituent at every conceivable moment; just as the world which in ordinary life we experience at rest, this world which outlives myriad generations of individual lives, is moving at a velocity which, could we become conscious of it, would bewilder us; so life itself, which seems independent of its history, is history, and philosophy is its interpretation. There is no past; history is present reality. This sounds a paradox because we identify history with what is past, and if there is no past, then there is no history.

I mean that present and past are not separable, not independent existences externally related, but one concrete fact. In separation from one another each is a pure abstraction and baseless.

To most readers this may seem a difficult and unusual, perhaps even a fantastic view of philosophy. I shall make my view clearer if I take an actual example. I shall also, I hope, reveal thereby the clue to the right understanding of how to read philosophy. Let us take, then, as our illustration that great work which, whether judged by its intrinsic merits or considered in regard to its enormous influence, is the outstanding landmark of modern philosophy, the *Critique of Pure Reason*, of Immanuel Kant. Heine said of Kant's great work that it had slain the God Jehovah. It was a wrong judgment, if we understand it to mean that Kant destroyed the belief of mankind in a spiritual order, or that he revolutionized the accepted basis of religious faith. It was a true judgment in so far as it meant that the revolution in thought which Kant effected extended to the highest realm of human experience. No book ever written, if we consider its indirect as well as its direct influence, has so profoundly altered the whole outlook of human thought and the course of its development and enlarged our concept of mind. How ought we to read that book? There is one way, and only one way, to read it if we would possess its pure philosophic value. We must read it as the concrete presentment of the living thought of one who gathered up in himself and represented, and could express, the mind of his age. It is not what Kant would himself have written, or could have written, had he been living in our world to-day; but his thought is woven into our life and

into our living thought, and this possession we can only realize to the extent to which we are able to install ourselves within the world of his thought. How can this be done? It seems to make philosophy very difficult, to restrict it to specially sympathetic minds, possessed with more than the usual share of the historic sense. It is not so. So far from making philosophy difficult, it makes it easy by bringing it into direct relation with life.

It is not the usual way. There is an immense Kantian literature ranging from historical treatises to the most minute and laborious exegesis. There are treatises showing the influences, actual or possible, which determined the matter and the form of the philosophy. There are treatises showing the implications which only became explicit in later developments. There are arguments to prove that Kant did not, or that he did, answer Hume; that he was, or was not, an idealist; that he was, or was not, a realist. They all have their interest, but they lose that interest the moment they lead us (and this is their tendency) to forget that the philosophy of an age reflects the concrete life of the age. Once let us feel that the problems of philosophy are external and changeless problems, the answers to which are true or false, and philosophy becomes a dead thing, whose interest is purely archaeological. Let us feel, on the other hand, that the scepticism of Hume, the Deism and the Humanism of the eighteenth century, the nature worship of Rousseau, the great ferment of the Revolution, are, one and all, together with countless other influences, woven into the web of that extremely complex reality, the mind and the world of Kant, and his treatise is no longer merely and only a theory

of knowledge which may be right or wrong, no longer a matter of antiquarian interest; it enters into our present life and becomes continuous with it.

This is what I mean by the historical concept of philosophy. Once grasp it and we see that the *Critique of Pure Reason* is part of our actual philosophy to-day. Philosophers are not to be grouped into post-Kantians or neo-Kantians, nor into pro-Kantians and anti-Kantians, but our living thought to-day is directly continuous with the thought which was living thought in Kant's day. Philosophy is not an edifice to which each philosopher may add a story. The *Critique of Pure Reason* is not a stone, not even the corner-stone, of a building: philosophy is the life of mind, and each philosopher in giving it expression also gives it direction.

Let us now compare this way of reading the *Critique of Pure Reason*, which we will call the historical method, with the other and more usual way, which we will call the scientific method. The comparison will make clear the true nature of philosophy itself. We can study the *Critique* as (what it is) a treatise setting forth a definite theory of knowledge, logically propounded, scientifically defined, and mathematically demonstrated. Such a method, it may be said, should appeal to us, for obviously it must accord with the primary intention of the author in writing his book. The work will now present itself as a discrete body of particular doctrines, and the judgment we shall pass on the whole will be determined by the investigations of the different constituent theories which compose it and their logical relatedness. Before we can pass any such judgment on the whole we shall have to decide minutely the truth

or falsity of each position involved in the argument. It is clear on such a method there is not only no finality, but that the immediate end in view, the grasp or attainment of a theory of knowledge, must recede as the study advances. This is not necessarily discouraging. It is characteristic of scientific method to keep narrowing its inquiry and to grow ever more abstract as it progresses in its search for truth. The way of philosophy is another and different way. Philosophy is ever in search of concreteness and universality. For philosophy, therefore, the *Critique of Pure Reason*, however much it may be a scientific treatise, is primarily a work of art, with the unity, indivisibility, and individuality which a work of art possesses. This means that it was conceived as a whole, then worked out into its parts, and not built up laboriously out of minute and accumulated investigations. If we would understand it we must first grasp the whole, otherwise the parts will be meaningless. As a poet gives in a poem, or as a painter throws on a canvas, the image which expresses his individual intuition, so the philosopher gives to his treatise the concept which expresses his individual thought.

Let us then, in reading philosophy, seek first to understand and not to overthrow. It may sound like the scholastic maxim, "Credo ut intelligam"; it is, in fact, very different. The scholastic maxim is based on the conception of a philosophy of history. Our maxim is based on the perception that history is philosophy, and that no philosophy is final because history is never complete.

I have taken as my example the *Critique of Pure Reason*, a long and difficult work, the English trans-

lation containing over five hundred compact pages. Is there not, then, I may be asked, some easier access to the arcana of philosophy? Can we not have the problems explained to us in advance? The answer is that we can no more learn philosophy without reading the philosophers than we can learn to swim without going into the water. But philosophy is not difficult when once we understand its place in mental life. It is the expression of the thinking activity which starts in wonder and leads on to continual speculation.

IV

ACHILLES AND THE TORTOISE

In the beginning of the history of Western philosophy in ancient Greece the first reflections of philosophers on the nature of the physical universe led to the formulation of two antithetical principles. According to one nothing moves; according to the other all things flow. Aristotle, in the *Physics*, tells us that Zeno of Elea was the champion of the one, Heracleitus of Ephesus the champion of the other. One of Zeno's famous arguments has puzzled logicians of every school and of every age from his time to our own. It is known as Achilles and the tortoise. Achilles, he said, can never overtake the tortoise if it has been given a start, for while Achilles is reaching the point at which it is when Achilles sets out, the tortoise is moving on, and while Achilles is moving to that further point, it is still moving on, and so *ad infinitum*. Achilles is for ever in the position of having still a step to take. This was no paradox to Zeno, because it was in full accord with his principle that nothing moves, but it is a paradox if we hold that there are real movements. I am not, however, concerned with what Zeno meant, but only with the modern solutions which are being offered to-day of this ancient riddle. It seems to me that nothing

illustrates more strikingly the antithesis between the principles of the new realism and the new idealism than our attitude towards this old problem. It is in fact an admirable test by which we may compare the scientific workability of the rival philosophical principles.

The principle of the new idealism is that movement, activity, change, becoming, are original, and that all objective fixed forms, that is, objects of ordinary experience, such as mountains, streams, rainbows, clouds, are derived, and that the concepts of physical science, such as electrons, atoms, molecules, are constructed. Idealism finds this original activity in mind or spirit, and mind is conceived as pure act. The principle of the new realism is the direct antithesis. The interpretation of experience is only possible, according to realism, if we assume that mind is passive to the revelation of an external reality, and active only in attending, selecting, discerning and discriminating what is presented to it. If in the light of these opposite principles we examine the modern claims to have solved the ancient paradox of Zeno we shall find that if we follow the principle of the new realism the puzzle remains and the contradiction is as pronounced as ever it was to the old Greeks; on the other hand, if we follow the principle of the new idealism the position is turned and the contradiction disappears.

Let us first ask, then, whether we can reconcile the contradiction, consistently with the realistic view, viz. that there are things occupying space and enduring through time, and that movement is the passing of a thing from one position to another, through all the intervening positions, during a period of time which

elapses from one moment to another, through all the intervening moments. The obvious paradox in such a statement is that there are infinite points between any two points in space and infinite instants between any two instants of time, and consequently in moving we seem required to exhaust an infinite number of points and instants. But modern mathematics claims that by its definition of infinity and its doctrine of the nature of a compact series the paradox in the concept of infinity is overcome. The logico-mathematical philosophers tell us further that the plausibility of the old puzzle rests entirely on a supposed contradiction in the concept of an infinite series which modern mathematical theory has completely reconciled. Let us see if this is really so.

The old idea of infinity, we are told, was based on the impossibility of setting a limit to an extension in space or to a succession in time. Thus when a line was said to contain an infinite number of points this meant that there is no point at which the line comes necessarily to an end, no point beyond which it cannot be extended. Any definite part of such line, however, would consist of a finite number of points. I do not know what the evidence is for this. There are modern mathematicians (Petronievics and others) who hold what is termed a finitistic theory of space, but this is purely a mathematical question which does not affect our present problem. Whether any mathematician in ancient or in modern times has actually held that a line is constituted of points, and that a finite line consists of a finite number of points, or whether such a view is only inferred from the general argument, I do not know. In any case the modern concept is clear. According to the modern doctrine of infinity

there is an infinite number of points in an indefinitely extensible line, and equally there is an infinite number of points in any definite part of such line. The relation of part to whole does not involve the relation of more and less in the number of points into which the whole or the part is divisible. Infinity is not reached by summation but defined by character. An infinite number is a compact series. A compact series means that between any two members of the series there is another member, so that no two members are next one another. The relation between two infinite numbers or two compact series, even when one is part of, or contained within, the other, is not a numerical difference, but a point-to-point correspondence. There is a corresponding point in the one to every point in the other. When this is applied to the problem of Achilles and the tortoise it is claimed that the contradiction is reconciled. If Achilles, so the argument runs, steps a yard while the tortoise steps an inch, there are not more divisions in the one movement than there are in the other. Although the one is contained within the other, there are infinite points in each, and there is a one-one correspondence between every point in Achilles's step and every point in the tortoise's. Achilles therefore, in order to overtake the tortoise, has not to traverse more points than the tortoise traverses. He overtakes it because the relation of their steps is that of whole to part. The point-to-point correspondence is neither an impediment nor a contradiction. In this way it is claimed the ancient paradox is got rid of. Is it so?

A very little reflection will convince us, so at least it appears to me, that the paradox is still there, and there in a still more obstinate form. The mathe-

matical doctrine does not enable us in any way to prove that Achilles does or can overtake the tortoise; it only enables us to say that, if we *assume* the movement, then the compact series of points in each case will not prevent Achilles overtaking the tortoise. For if we *assume* the movement, then, as the tortoise's line will form part of Achilles's line, the infinite discreteness is irrelevant. But it is this discreteness which makes the conditions of the movement we are assuming impossible. To meet the difficulty we must abstain from *assuming* the actual movement, and simply set ourselves the task of showing how, if the movement is to take place in accordance with the conditions we lay down for it, Achilles will overtake the tortoise. We shall find this absolutely impossible. The tortoise is ahead of Achilles in the race which is yet to start and we are to explain how at a definite point-instant Achilles is to overtake the tortoise. But there is a point-to-point correspondence between the projected movement of Achilles to the tortoise's starting-point and the projected movement of the tortoise to its new position, and so on to infinity. The contradiction so far as it attached to the infinity of the points may be overcome, but not the contradiction in regard to the infinity of the series of steps Achilles has to take.

Yet this new mathematical definition of infinity may enable us to see better than ever before the exact difficulty in regard to the concept of movement. Movement is essentially continuous and indivisible, whereas the mathematical infinity is essentially discrete. If, then, space and time are the multiplicities which mathematics, in defining the infinity of their points, declares them to be, and if they supply the prior conditions of movement, then movement itself must be

discrete, and that is as much as to say that movement is a compact series of rests and not movement at all. Movement in such case will not be a passage from one point at one instant to another point at another instant, but a series of disappearances and reappearances. If this is our view, what else can it mean than that we agree with Zeno that nothing moves? If with new realism we postulate the original independence of the external world with its framework of space-time there is no alternative. The only alternative is to reject the postulate of realism and accept the principle of idealism.

This alternative is, to accept movement as original, and not as conditioned by a prior reality, and see whether, without contradiction, space, time and matter may be generated from movement. The attempt at once strikes across the settled convictions which express our natural mode of thought and goes contrary to the practical habits which form our ordinary actions, but we may find notwithstanding that it is a perfectly rational concept and leads to no self-contradiction. It is clear at once that if the discreteness of space and time is generated from movement, and not its condition, then the paradox of Achilles and the tortoise disappears. Let us try. We start with the two movements, taking them in their simplicity as indivisible wholes, just in the same way as we take the life of a man as indivisible. The man might, it is true, die at any moment of his life, so likewise a movement might stop at any point in its duration, but that does not make a man's life a compact series of deaths, nor does it make movement a compact series of stops. What, then, are these points and instants which are imaginary deaths in a man's life or imaginary stops in the course of a movement?

They are not constituents of the one or the other, they are our intellectual device to enable us to measure. It is because they are not constituents, because they are not actual arrests but only possible arrests, imagined and artificially conceived, that their number is infinite. The extension or space-time which contains these infinite imaginary stops, and which we conceive as spread out beneath, or placed as a background behind, the movement, is then a dimensional scheme by means of which measurement is effected and movement intellectualized. If this be the true order, then all difficulty in understanding how Achilles overtakes the tortoise is gone, for there is now only one way of comparing the two movements, and that is as indivisible wholes. Only as integrals are the two movements relatable, and so the overtaking is a simple description of an actual relation. When we measure each movement by our dimensional space-time scheme, then we can indicate points and instants at which it might have been arrested, but any such arrest, had it been actual, would have destroyed the movement.

The idealist, however, even if this argument is sound, is yet a long way, it will be said, from providing us with a concept of pure movement, pure activity, pure change, the pure act. It is Achilles and the tortoise who move, and who if not moving would still be Achilles and tortoise, whatever difficulty we may have overcome in explaining the relations to one another of their movements. They at least are things in space-time which may either move or be at rest. We may generate rest from movement, inertia from activity, permanence from change, but we can only give meaning to any of these activities by supposing things. This is undeniable.

We can only apprehend movement as a relation dependent upon terms. An essential principle of idealism is, however, to deny the externality of relations. The concept of external relations is according to idealism the source of the contradictions which realism cannot escape. In this case clearly the movements of Achilles and of the tortoise are not an external relation but part of the concept of them, and yet Achilles and the tortoise themselves are other than their movement and clearly not generated by it. The reply to the objection is therefore that we require terms, and in this case our terms are selected *ad hoc*. But if we choose to carry further the analysis of the terms, we shall discover in their case, as indeed in every case of every object of ordinary experience and of every concept of scientific reality, that they are ultimately resolved into the aspect of some process on which their existence depends. This is not especially a philosophical discovery, it is a scientific generalization. Every object which presents itself to our apprehension as a thing, fixed and abiding, refers to an originating activity and not to an original stuff. This is the meaning of the scientific doctrine of energy. A thing is what it does, and doing is more original than being. Our mode of apprehension and our mode of action require us to give fixity to our frame of reference, but the fixity is purely relative to our activity. If becoming were to cease we should be at a complete loss to conceive being.

Let us now try and penetrate somewhat deeper into the principle of idealism. There are only two ways of trying to understand, *i.e.* to obtain knowledge of, the nature of anything. One is to observe its outward behaviour, the other is to install oneself within its

life. If the thing in question be an ordinary thing, such as we meet with in daily experience and regard as external to and independent in its existence of our experience, then both these modes seem defective in what is essential to the success of either. For in the first case it is impossible to dissociate the interest of the observer in the selection of what he observes. In the other case it is clearly impossible to enter into and live the life of another save only by a kind of analogy. Are, then, the two modes on a par? Clearly not, for there is a fact of experience more fundamental than either and most illuminating when we attend to what it implies. Each of us as a subject of experience is immediately and unambiguously installed in reality. Each of us is primarily a centre of originating activity. Each of us in the "I think therefore I am" is conscious of a knowing which is being, and a being which is knowing, and a being-knowing which is a continuous becoming. Compare the two modes in the light of this fact. The one is the way of realism. It assumes the existence of the physical universe and reduces the consciousness of the "I think" to the endowment of an object in the universe with a power of passive contemplation. It takes the natural order to be the actual order. It describes and it infers. It is content to chronicle the order of emergence of qualities, to note the behaviour of an active being, and it acquiesces in complete and necessary ignorance of its inner working. The other is the way of idealism. Idealism makes no assumptions about the physical universe, for it needs none. Its central fact is the activity of conscious subjects and each subject's immediate consciousness of its own activity in living experience. Even reflection on experience is experi-

ence, and reflection depends on the indivisible continuity of the active life in reflecting. But what we discover the moment we reflect, and whenever we reflect, or even when, without reflecting, we allow the rhythm of our duration to come to consciousness, is that what we are aware of in consciousness is not fixed, static or permanent, but a continuity of unceasing change. We see at once that the states into which we divide our experience for practical convenience are a mere device and that our life is a continuity of becoming. Spinoza said that the main cause of error in philosophy was the failure to recognize that the divine nature is prior, alike in the order of knowing and in the order of being. If this primordial divine nature be conceived, not as Spinoza conceived it, that is, as substance or universal being, but as universal becoming, we have the principle of the new idealism.

If we accept this principle, however, do we not in effect reduce the substantiality of the universe to illusion, and does not this conflict with the deepest instinct of our nature? We can point to nothing in our experience which justifies the ultimate changelessness which the concept of substance seems to affirm. The things which to us are enduring are so only relatively to our own transience. The hills which we speak of as everlasting do literally, in the words of the psalmist, "Skip like lambs." Yet, although we recognize that all is changing, we still find it impossible to conceive the ultimate support of all existence otherwise than as unchanging substance. The task of philosophy, for the idealist, is to show how the illusion arises and why it must arise. The answer comes not from philosophy but from science, and it comes with striking force in the principle of relativity.

It is the essential condition of the observation of physical phenomena and of the co-ordination of observations by which science determines the laws of nature that the observer should take for his frame of reference a system at rest. And this very necessity arises from the fact that there is no absolute system at rest which those attached to relatively moving systems can discover and use. Here, then, is the source of one illusion and the justification of it in practice. Let me take an illustration, of necessity largely fanciful. Suppose a spiral movement, such as the upward curve by which an aviator rises to a higher plane. A bird moves in precisely the same manner, following, as we say, the laws of moving bodies, of which laws, since it acts by nature and does not learn by experience and reasoning, it can know nothing. Now consider the difference of the identical fact in the consciousness of each. The man compares the curve with an ideal perpendicular line. Does the bird? The improbability of it doing so amounts to practical certainty that it does not. To the bird the spiral must be the straight line, because it is for the bird the shortest path, and any difference which might appear to it on reflection, were it possible for it to reflect, could only appear as a function of its velocity not of its direction.

In my view the principle of modern idealism that activity is original, and that we have immediate experience of this originating activity in the " I think therefore I am " of consciousness, is the only principle which accords with the teaching of modern science concerning the reality of the physical universe. It is the only principle which reconciles completely the paradox of Achilles and the tortoise.

V

THE FUTURE OF BERGSON'S PHILOSOPHY

The history of philosophy is marked by great discoveries, each associated with some individual mind. Many on this account deny that philosophy has a history in the true sense of an evolution, and consider it only a record of the brilliant but vain guesses at truth which have occurred from time to time to men of exceptional intellectual power. Philosophy, moreover, is generally regarded as so essentially speculative, in comparison with physical science, which is severely practical, that philosophies are ranked with works of art and philosophers with men of genius. To those who take this view philosophy may represent the height of human attainment; it may gratify the sense of spiritual superiority over creatures who have nothing to spare of the activity required to maintain their life; it may minister to intellectual pleasure; but it does not respond to any direct appeal of the life principle itself. There is another view, however, according to which philosophy is a distinctively human need, the response to a deep-seated craving which is the very principle of life itself, the possession of the freedom and the power which knowledge only can bestow. To those who take this view philosophy is

an evolution marked by stages, each stage registering an advance, and each advance, in widening the range of activity and increasing the efficiency, preparing the ground for a new advance. Socrates is the father of philosophy because of his discovery of the concept, a discovery which made possible the work of Plato and Aristotle. In the modern period, philosophy, in the technical meaning we are now accustomed to give it, begins with Descartes's discovery that the criterion of truth and reality is not conformity with what is evident to the senses, but clearness and distinctness of conception in the mind. This discovery made possible the great development of the systems of Spinoza and Leibniz, while these again, by the contradiction they evoked, led to the scepticism of Hume. The discovery by Kant of the a priori synthesis, the greatest discovery of the modern period, made possible the even more striking discovery by Hegel of the dialectic. It is easy to see that, however much philosophers today may criticize or reject these concepts, they are, and of necessity must be, completely dominated by them.

There is in our generation, living and working among us, a philosopher, Henri Bergson, who a few years ago rose suddenly to fame and, very unlike the typical philosopher, became a popular idol and attracted crowds of fashionable folk to his lecture hall. There are many who take this as confirmation of their view that his philosophy is shallow and attractive only in its novelty, appealing by its catchwords and picturesque metaphors to the popular fancy, destined like all fashions to have its day, decline, and be forgotten. There are some of us, however, who think that in Bergson we have a philosopher who will take rank with the great ones, with those who

have enriched mankind with a new concept, and made possible a new philosophical advance. I am one of those who feel this so strongly that in my visualization of the future, when our generation will be looked back upon as we now look back on the age of Descartes, Leibniz or Kant, Bergson takes a place among the world-philosophers. It may sound like foolish fancy, and perhaps it is—I only give expression to it in order to indicate the kind of greatness I attribute to Bergson. I think that, apart from whether on any particular problem of philosophy his theory is right or wrong, he is the discoverer of a new concept destined to lead to a great advance in human knowledge. It may be an extravagant, or at any rate an exaggerated, view, but I want to show that it is not irrational. Why I give expression to it in what may seem an extravagant way is because I am under the fascination of a striking historical analogy.

Science and philosophy are often represented as two divergent lines of human intellectual activity, having nothing in common and frequently exhibiting not merely indifference but definite hostility. Yet not only have they a common origin, historically they are closely and continuously connected. No one can understand the philosophy of Descartes, and the direction in which his successors developed it, who ignores the Copernican discovery which preceded it, the work of Galileo and Harvey and Gilbert which accompanied it, and the history of seventeenth-century scientific discovery generally. No one can understand the English philosophical movement in the eighteenth century who dissociates it from the triumph of the mathematical and physical principles of Newton. In like manner no one can understand the philosophy of

the present day who disregards its relation to the great biological discoveries of the nineteenth century. The analogy which impresses me is this: The beginning of the seventeenth century was remarkable for a great and complete change in the world-view consequent on the discovery of the earth's diurnal and annual movements, and of the heliocentric construction of our system. That discovery had been announced by Copernicus half a century before it was proved to demonstration by the invention of the telescope and the scientific discoveries of Galileo, which that invention made possible. The effect of that discovery was so completely to reform our knowledge of space as to make the old cosmology unthinkable. It was this new world-view which set its task to philosophy. It was a twofold problem, for, in the first place, the accepted criterion of truth was discredited; it was no longer possible to appeal to the senses, at least in any question which concerned motion. Also, in the second place, the image of an unseen spiritual world in actual spatial continuity with the seen world was destroyed. The discovery gave us in principle, if not yet completely in fact, the whole of our present outlook on space. In that great advance of human thought two names stand out pre-eminently representative — Galileo, who devoted himself mainly to experimental research, and Descartes, who set himself to interpret the significance of the discovery and who enlarged for us the concept of spatial reality. Two centuries elapsed before anything resembling the revolution in our concept of the spatial universe disturbed our concepts of time and history. Not until the nineteenth century, with its great biological researches, did the concept of time receive the

expansion which seems to us now to be practically involved in the notion of infinite space. In this recent great revolution in human thought it seems to me that in the future two names will stand out as pre-eminently representative — the great scientific researcher Charles Darwin and the philosopher Henri Bergson. They are not workers in the same field, and though contemporaries, the one was old and finishing his work when the other was beginning, just as Galileo was old when Descartes was young; but the researches of the one are the condition on which the philosophy of the other depends. Bergson is pre-eminently the philosopher of evolution.

The descriptive use of the cinematograph by Bergson in *Creative Evolution* to explain the theory of true duration and the mechanism of intellectual apprehension, is very significant in this connexion. The cinematograph is, in fact, to the new philosophy what the telescope and microscope were to the Cartesians. The cinematograph reveals the nature of time as telescope and microscope reveal the nature of space, but in each case it has needed a philosopher to interpret the meaning. It was the philosophers, not the inventors of telescope and microscope, who saw the significance of the discovery. The inventors thought merely that they had succeeded by a practical contrivance in enabling us at will to magnify the appearance of near and distant objects. The philosophers saw clearly that not the magnitude of objects but the concept of magnitude was in question. They saw that the instruments proved to demonstration that there is neither great nor small, that there exists no absolute standard by which things are measurable, that magnitude is relative to the observer,

to his standpoint and his viewpoint and the range of his effective action. (Any one curious to see how the new discovery of the microscope attracted and profoundly affected contemporary philosophy can find a perfect and typical example in Malebranche's *Recherche de la vérité*, Book I. chapter 6.) The cinematograph is in effect a time-microscope and time-telescope; it analyses time in an exactly analogous way to that in which those instruments analyse space. By means of the cinematograph we can submit an event—that is, any simple continuous action, a muscular action such as the movement of a limb, grasping an object, a bird flapping a wing, or a vital process, such as a flower bud opening, an embryo developing, or a physical process, such as a crystal forming or dissolving—to an expansion or contraction of its duration. We can magnify the time dimension of an event, or we can cause it to shrink to any extent we require and so adapt any event to the conditions which our standpoint of attentive observation needs. There are practical limits, of course, but theoretically there is no limit. If we could contrive an instrument of sufficient delicacy, we should be able to observe directly even single waves of light, billions of which pass in a second. So far as the principle is concerned, the cinematograph enables us to see events as they would appear to observers whose time-sense, or, as I should say, whose grasp of duration, is different to ours. Now just as the spatial instruments demonstrated that there is no unit of magnitude by reference to which anything can be declared great or small, so the time instrument demonstrates that there is no absolute unit of duration in reference to which any period can be declared long or short.

It seems to me, then, that the great movement of thought which we are all, each in his own way and each from his individual standpoint, engaged in, is an effort, consciously or unconsciously continued, to reform a world-view which has been completely upset by scientific discovery. Our effort and its conditions curiously resemble those of the seventeenth century, and we can learn much from the comparison. We know what the mediaeval world-view was. A perfect presentation of it exists in a great work of art: the *Divine Comedy* of Dante. The cosmology of that poem represents the world-view which in the course of fifteen hundred years had become so rooted in men's minds that it seemed to them as much part of their life as the light they see or the air they breathe. It was overthrown and the world-view had to be remade. The first complete attempt, magnificent in form and conception, is given us in the *Principles of Philosophy* of Descartes. So to-day a change has come in the concepts of time and history as great as that was in the concept of space. The long unquestioned belief that whatever the nature of the universe and the agency which had brought it into existence, it had come to existence as a definite historical event, is not only no longer believed but no longer conceivable, and this has necessitated a complete reformation of our world-view.

I will now indicate what seems to me the essential basis of the concept around which, if I am right, the new world-view is forming. The key word of course we know; it is evolution. The fact of evolution we all now accept; what we have to discover, and what we can only discover by philosophical and not by scientific research, is the nature of the reality and the

conditions which are consistent with the actual evolution of life as present existent fact.

Let us look first at the ordinary naturalistic notion of reality, the concept of reality which seemed at first almost involved in the very idea of an evolution of life. Because it was evident to observation that the higher, more complex, and elaborate forms of life were later in time than the more simple, and because the very notion of evolution involved the conception of the origin of higher and more complex forms from simpler and lowlier, it seemed to follow as matter of course that the basal reality must be conceived as extremely simple—an inert, almost propertyless stuff, occupying space and capable of change, that is, of altering its position in space by succession in time. It seemed then that only one thing was necessary—a little thing, mysterious it could not be denied, but still a thing we might hope would not ever remain a mystery—it was only necessary to suppose that with the changes of position of inert matter in space and time there arose combinations of elements, and that with the complexity of combinations there came into existence complex functions. This being granted, the whole history of the evolution of life, however difficult to reconstruct in details, seemed to rest on a simple natural basis.

This seemingly innocent working hypothesis is fatal to the whole conception the moment it is submitted to philosophical criticism. It is obvious, directly we reflect, that if it be a fact that complexity of combination gives rise to new qualities and initiates functions, so far from this being unessential and adventitious, it must be foundational. It supposes in inert matter a potentiality quite inconsistent with

simplicity, and in regard to which simplicity must be illusive appearance. At least, if the structure be as simple in fact as it is in appearance, the function cannot depend on it. Even the scientific view has not been able to maintain itself against this criticism. For philosophy, however, the whole concept stands self-condemned. It is based on a vicious principle. It sins against a fundamental law of thought. There exists no means by which the more can be derived from the less. Either life is a complicated arrangement of inert particles of matter, deducible from the shape of the particles and nothing more, and in that case it can only be automatic and mechanical; or else the supposed elements are not as simple as they appear to be, and then what philosophy must explain is their apparent simplicity.

Easy and obvious as this appears when once it is stated, it is the very reverse of obvious to the ordinary mind, because the scientific method is analysis of the complex into the simpler elements which constitute it, and when these simpler elements are separated nothing but a mechanical difficulty seems to interfere with their synthesis. There are, besides the elements, the conditions under which they combine; but these, like the elements themselves, seem discoverable. Underlying scientific method, it is easy therefore to discover the notion on which it depends, the notion of a reality fundamentally structural, whose ultimate distinctions are spatial, while function, quality, purpose, consciousness, are merely adventitious. If science seem limitless, it is not because reality is inexhaustible, but because the intellectual powers of apprehension, retention and discrimination are only with difficulty and by means of mechanical instruments extensible.

The true ideal of science is to exhaust an exhaustible reality—that is, to bring all reality within the compass of its ideal presentation.

It is this notion of reality which Bergson definitely rejects; let us see what he proposes to put in its place. The new concept is a revolution as complete as that which Kant described as a Copernican revolution in philosophy, although it is distinct from the problem of the Kantian philosophy. In the first place, then, the new concept of reality is not positive in the sense that there is a negative in relation to which we can define it. It is not a being or existence opposed to non-being; reality is not the opposite or contradictory of the concept of nought. The idea of nothing in the absolute sense is a pseudo-concept. We may present to the mind the absence of any particular existent thing, but absolute non-existence, pure nothing, is inconceivable. Reality, therefore, in the ultimate meaning is not the name we give to a mosaic of the real objects which constitute the world together with their spatial and temporal relations. It is existence which cannot even be thought not to exist. Existence is not something superposed on nothing.

Can such a concept of reality, even if we admit it, be the starting-point of a theory? And if it cannot be a starting-point for the reason that it possesses nothing definite and therefore excludes negation, can it have any philosophical value? The reply is that it is not the starting-point of theory, nor yet is it an assumption, or postulate, or axiom, which we start by taking for granted. It is not the position from which the philosopher starts, it is the warning notice which points his direction and prevents him from taking a false route. Reality cannot be starting-point

or goal of knowledge, because life and knowledge are identical with it; it never confronts them, for it cannot separate itself from them and stand outside of them. This in itself serves to bring into relief the futility of the scientific ideal of a reality which is the condition of life and the object of knowledge.

Let us leave, however, the general consideration and come to the positive and more distinctive feature of Bergson's concept. According to the ordinary and scientific view, we are living beings endowed with consciousness or awareness, confronted with a reality which it behoves us to understand in order that we may adapt ourselves to the conditions of life. Knowledge consists in discriminating the qualities and modes of reaction of the objects which together with ourselves are members or constituents of this world. According to Bergson's theory, on the other hand, we are centres of activity in a universal activity. To live is to be one of the forms in which the activity, life, is now evolving. A living being is a focus of this activity. In this focus the energy of life is concentrated in a tension—*i.e.* there is a contraction, a holding in and drawing together of force, which can be released and extended in directed action. Consciousness or awareness is a special mode of this activity evolved to advance and serve it, relative to its needs and conditioned by its range. Knowledge is not contemplation of a static reality independent of the living being and the sphere of his action; it is an instrument of the activity it serves and strictly relative to it. It is the presentation in idea as already completed and accomplished of the actions we are engaged in performing, before they are performed.

The great contrast between the naturalistic view

and this new concept, and the distinctive feature of Bergson's doctrine, comes out most clearly in his theory of the mode of conscious activity. Life and consciousness are identical—that is, there are not two realities, one of which, as it were, surveys the other. The distinction is purely modal. If, that is to say, we conceive this activity or reality (they are synonymous terms) in the most general way possible to us, then there is no difference between what we call life and what we call consciousness. But activity to be effective must concentrate itself, and it is in this concentration that the difference between life and consciousness arises, because in it unconsciousness plays a definite role. Just as we contract the diaphragm of a camera, shutting out light, in order by concentrating and narrowing the image to obtain sharp definition, so life produces actions by darkening in unconsciousness all that could distract attention and blur the necessary image. It is the contrivances and mechanisms and inhibitory artifices that restrict and limit our view of reality which make the world appear to be constituted of definite objects. Objects are in fact defined not by what we see but by what we are prevented seeing. I take the visual sense for my illustration because it is typical of the mode of sense-apprehension generally and also because it gives us the clearest illustration of meaning. The colours of the spectrum are a selection which our optical sense-organs are specially contrived to effect. Science has taught us that nature itself possesses no distinction between a visible and invisible spectrum; it is purely by our power of being insensible to all but the narrow range of the visible spectrum that this spectrum becomes articulated and possessed of sense

qualities which are relative to and serve our particular mode of activity. Now compare this with the naturalistic view, according to which the articulation of our knowledge corresponds to the articulation of the real, and the objects we now possess, *de jure* and *de facto*, are the outlines which serve for their demarcation. Science in this view must be the work of discriminating, classifying and arranging these objects. The ideal of perfect knowledge is for naturalism the concept of a mind possessing in idea the whole of reality as it is in fact, and the ideal is unattainable not on account of any theoretical defect but purely because in practical life we are limited in duration, in grasp of simultaneous apprehension, and in continuity of intellectual effort. These very limitations, which in the naturalistic view constitute defects, are in Bergson's theory positive acquisitions, essential to efficiency in action. In a certain sense we may say that the more we know the more ineffectual we are. Both physically and psychically we are constituted by mechanisms which limit our range and in so doing concentrate our force, the force of the life principle acting in and through us. Let us go further and apply this theory to the principle of evolution itself. When some new form of activity is called for, requiring for its attainment some new mode of consciousness, the life impulsion has not to devise for its outlet some new construction of a definitely shaped matter, which in some mysterious way will acquire by the new combination some new function, a function distinct from anything implicit in the elements themselves; all it has to do is remove the shutter, alter or adapt the mechanism, admit to consciousness some part of reality previously excluded, make the living being

unconscious of everything which would distract it from the new purpose. Evolution can proceed thus because reality is the activity of which and in which we are acting centres; because reality is not a static, inert sphere independent of us and limiting us; because in consciousness we are not aware of something opposed to us and independent of us. Reality takes its objective aspect for us because we have actions to perform.

This, then, is the principle of selection which Bergson opposes to the naturalistic principle of discernment or discrimination. The application by Bergson of this method is most strikingly illustrated in the theory of perception and memory expounded in his *Matière et Mémoire*. Perception of objects in this theory is a selection of images, a selection effected by shutting out in unconsciousness the whole of reality unconcerned with the living actions we are performing, or rather with the kind of influence we exercise. The outlines and boundaries of objects—the things which we perceive—demarcate lines along which our present progressing action is forming. The selected images accordingly outline a certain eventuality of action. Selection of images does not mean that there is an act of the mind, such as some philosophers name the act of perceiving, which from a variety of images actually present pays attention to some and disregards the rest. Neither does it mean that images are representative of real objects. Very different is Bergson's concept. In perceiving we are directly and immediately conscious or aware of the reality we perceive; the images do not intercept our view, nor mediate our view; they are constituted images by the selection, and the selection is determined by

the form of our actions, and these by the needs, the range, and the mode of our activity.

This principle of selection interprets memory of the past as well as perception of the present. Memory is present reality. It is past only in the meaning that it is accomplished action. It is not past in the sense that it does not now exist. We carry it with us; it is what we are, our very selves; it is determined and it is determining the form of our progressing action. The present loses all meaning if we cut it off from the past, because all reality is history and history is making itself. The past is wholly existent in the present, it constitutes each individual experience, it constitutes the racial experience, it constitutes the evolution of life. It is with us always, an ever-present spiritual existence. It lies behind us and we are unconscious of it, for life requires that our attitude should be continuously, even strenuously, forward looking. We are fixed in this attitude of attention to life, but action requires the service of the past as well as its impulsion. At every moment of present perception the shutter is drawn aside according to the needs of the situation and memory-images come to consciousness. They appear framed and with distinct outlines, but their sharpness and discontinuity and individuality are due to the selection. As in the selection of the perceived images, so in the selection of the memory-images, unconsciousness, not consciousness, is the positive agent and plays the determining role. The reality is there, and we become conscious of it when the mechanisms of unconsciousness are relaxed or inhibited. The memory-image does not stand for the past or intercept our view of it; it is formed by selection. It is not a special kind

of thing preserving the past, stored in the brain as we might keep the photograph of a friend in a drawer; it is vision of the past which is sweeping on with us in our present activity, vision made possible by removing a veil.

This theory of memory is perhaps the clearest and the most original of all Bergson's applications of his principle. It shows us the ground in fact of the radical reformation of the concept of reality which his philosophy represents, the substitution of the concept of pure duration for the concept of extension or absolute space. It involves the recognition that reality is fundamentally psychical, for only what is psychical endures. Time in the sense of succession is not duration, it is a dimension spatially conceived. Extension is not absolute, but purely relative to tension. Duration is absolute. It is the actuality of activity, and includes and conditions it. Duration means that the past is present, not only present in the shape of more or less dim traces or recollections of what has been, but actually present as the very substance of activity continued in and determining the forming action. It is the fact of memory which reveals to us the utter insufficiency of the old static concept of reality and at the same time indicates the new concept. The concept of physical reality, of a matter occupying space and changing its relative position by the succession of its states in time, is essentially discrete. Space and time as principles of continuity are external imposed conditions. Only in consciousness have we the pure fact of duration, and memory is a fact of consciousness. If the universe *endures*, it must mean that it is not an aggregate of discrete momentary existences, it must

mean that it lives, that its reality is not matter, but history. This is the new concept.

The old concept was of a reality on which life and consciousness depend; the new concept is of a reality of which life and consciousness are modes. Modes are not dependent on reality, but identical with it. The physical or material universe in the old concept is essentially inert, movement and change being something added to it or imposed upon it and constituting it a system of external relations. In the new concept reality is activity and matter is an aspect or view. The physical aspect of the universe with its appearance of independence is itself a result of the evolution of life. It is correlative to the mode of intellectual activity evolved in human nature. Let us see then how the fact of memory stands in regard to each concept.

According to the mechanistic view, the physical universe is completely determined by the compensated actions and reactions which constitute it a system. This is expressed in the law of the conservation of energy. The present state of the universe is in this concept completely determined by the past, and every future state of the universe is implicit in the present, but only the present state actually exists. The fact of memory, to conform with such a concept, can only be explained by supposing that this material momentary universe retains in its present configuration the traces of its former configuration, and that there is a mental faculty of using this property to represent ideally the past. The past in this case exists only in idea, not in fact. According to the new concept, on the other hand, the past which we remember exists in fact, and in memory we are simply conscious or aware of what

is as actual in its own right as the world we perceive. It is not in the existence or non-existence of their objects that memory and perception are different. In memory the acted past, in perception the progressing action, comes to consciousness. This actual existence of which in memory we are conscious is not material or physical, but spiritual or psychical. It is psychical existence because in mind alone and not in matter is there true duration—*i.e.* the existence of the past in the present.

This affirmation of an existence which is immaterial and yet actual is free from the ambiguity of the old idealism. That never succeeded in throwing off subjectivism. "The world is my idea" is a proposition no one can refute; but it carries no conviction, simply because there is no passage to objectivity and therefore no basis for physical science. "The world is history making itself" may sound paradoxical to us under the spell of the old concept, but it is not ambiguous and it is not self-stultifying. It affirms a reality which is psychical without being subjective. It declares that the substance as well as the efficiency of the objective world of nature is the acted past, actually existing in, not simply externally continuous with, the present. It is a concept from which scientific advance can be made. It is based on the fact of experience that the past of each individual is ever-present and ready to come to consciousness whenever the artifices which conceal it afford the means.

Such is the new concept of spiritual reality. Instead of matter and movement conceived as the conditions on which life and consciousness depend, we have history and evolution as the present existence of which life and consciousness are modes. In the

new concept, however, matter and movement are not nothing and they lose nothing of their claim to be real. What is denied is their claim to independent existence in abstraction from the whole. In the concrete activity, life, they are dispositions whose form is determined by a particular mode of conscious activity, the intellect.

The fact of memory when we grasp its full significance in the new concept transforms completely the problem, baffling from the standpoint of the old concept, of the relation of consciousness and life. I have spoken of them as conjoined—in the new theory they are identical. It is very important to make this clear because it expresses the philosophical principle directive of a new science, the science of unconscious mind. The argument is that memory, if accepted as fact and not explained away by some theory of imprints or traces, implies that the fundamental reality is continuous, not discrete. It is only living activity whose essential nature is continuity. When, then, life is conceived as itself the fundamental reality and not as something superposed on inert matter, unconsciousness ceases to be a pure negation, the simple absence which serves to distinguish the inert from the living. Unconsciousness and consciousness become strictly relative terms; both are modes of the life activity and it is unconsciousness which plays the active, consciousness which plays the passive, role. Thus, for example, when we fall asleep, unconsciousness is not the absence of consciousness in the sense of a break of continuity of consciousness; it is the cessation of a mode of activity. When we awake, consciousness does not return as an effort to revivify past impressions; it is simply the resumption of the

activity which unconsciousness had suspended. Life is not an activity which may or may not acquire consciousness; it is identical with it. Unconsciousness represents its mode of concentration, or contraction, or tension, a mode necessary for its efficiency in action.

One question remains. Why, if this be so, does it not seem so? In this question there is involved the whole problem of modern philosophy which began with Descartes's discovery that the senses are not trustworthy in the search for truth. It is nature itself which seems to teach us that the material universe endures by reason of the indestructibility of the material which composes it, and changes by reason of the spatio-temporal relations which condition its matter; but if the philosophical principle I have tried to indicate be founded on a true concept of the nature of reality, then we must suppose that mankind is under a hallucination, that it is hypnotized, as it were, by some irresistible influence which fixes it to the image of physical reality. This is what Bergson has called the cinematographical illusion. We suppose that reality is ultimately decomposable into fixed immobile states like the separate pictures unrolled before us by the cinematograph and that movement is our view of their succession. We neglect the prior fact that the true movement is the original from which the pictures were derived and that the pictures are not images of the fixed states whose succession composed the movement, but successive views taken of the movement. But though this may explain the nature of our illusion, it does not throw light on its purpose. To interpret this purpose is the dominant theme in Bergson's philosophy. The intellect is a mode of

conscious activity, a product of evolution, whose distinctive character is its orientation toward matter and materiality. The aspect of the world which presents to our mind the fixity and separateness and sharp definitions and outlines of the objects which compose it, is due to an artifice which conceals from us the flux and leaves our attention engaged on the points which concern our activity. Thus our new concept is seen to give birth to a new working principle. Efficiency, or the expression of activity in action, is dependent on a power of occlusion or exclusion. As living beings, in order to be effective we must be able to be ignorant of all the reality around us, oblivious of all the experience behind us, except just so much as interests and concerns and serves the action continually going forward.

Such then, it seems to me, is the new concept which Bergson has discovered. Like all great discoveries, once it is made, it appears obvious and self-evident and we are left wondering why no one thought of it before, why it remained so long unknown and required a man of genius to point it out. For it is a new concept notwithstanding that, like all things new, it is only a recovery or reconstitution or reinterpretation of ideas that are old. It would be difficult, indeed, to single out any particular doctrine of Bergson to which some close parallel in older philosophy could not be discovered. His main thesis is as old as Heracleitus, who taught that all things flow. It is not novelty or new creation that I claim for Bergson in the meaning that he has conceived an idea which no one had ever conceived before; what I claim is that he has proposed a new working concept, a concept which in pointing a new direction opens out the

prospect of a new advance in human knowledge and the power for action which knowledge brings. The impulse of life is economical and relentless. It has evolved the intellect, but the intellect must serve it or life will scrap it.

VI

BERGSON'S *MIND-ENERGY*

The conception of mind-energy not only implies a new concept of reality, a concept which identifies it with life and mind in the place of the old concept of something (it might be material or it might be spiritual) on which life and mind depend, and by which they are conditioned, but also it indicates a working principle of the highest scientific importance.

We are accustomed to think of psychology as the latest comer into the circle of the exact sciences, but there has recently arisen a new psychology of which the new psychologists of a very few years ago hardly dreamed, a science of unconscious mind. It threatens a complete revolution in our ordinary concepts of the mind and an entirely new basis for the science of it. Bergson was one of the first to feel the direction of this new science and to indicate the method of pursuing it, and his philosophical concept and principle are completely vindicated in its success. The main psychological problem of the past was to define the nature of consciousness, explain its genesis, and determine its relation to the external reality which was supposed to condition it. If we accept the new concept the problem of the future is to explain the nature and genesis of unconsciousness.

Let me illustrate what I mean by referring to what will probably be allowed to be the most original application of the concept—the theory of Creative Evolution. The generally accepted biological hypothesis is that life appeared on our planet at first in an extremely simple and lowly form (whether it was a direct consequence of the growing complexity of molecular structure in certain forms of inert matter, or whether it was introduced entirely from without, biologists are not agreed). But life, once installed in matter, is supposed to have gone on producing new forms, each responding to the conditions of the environment by some special adaptation. Its highest achievement is the human brain with its accompaniment of self-conscious mind. There need be no dispute about facts. If we could be satisfied with description there would be no more to be said. The problem, however, which baffles the naturalist at every stage is to explain the driving force of evolution, to discover in the old and therefore simpler forms, the efficient cause of the new and highly specialized forms. The theories of natural selection, survival of the fittest, transmission by heredity, are helpful and valuable in their way, but entirely useless to throw light on the problem. Why is there growing complexity? Why does complexity of structure entail higher function? How from the simple can come the complex and from the less the more? Compare now the theory of creative evolution. According to this theory consciousness is not something more than life, an acquisition or addition to it. Let us see its application to the biological problem as ordinarily understood. We have then as in the biological theory of evolution a first appearance of life

on the planet in a lowly form. In the theory of creative evolution life has humbled itself in order to insert itself in matter. By what means has life accomplished this work of insertion which the initial effort required? By clothing itself, as it were, with unconsciousness, that is, by contriving artifices and mechanisms which inhibit consciousness. Of course this is expressed in anthropomorphic terms, — how else can we express any meaning? Once seize the concept, however, and we find we are possessed of a principle which really works. We can explain the evolution of life, or at least we can study its process and its progress, without the dissatisfaction which haunts us when we are conscious of a suppressed paradox and direct logical contradiction. According to the new concept, when some new form of activity is called for, requiring for its attainment some new mode of consciousness, the life impulsion has not to devise for its outlet some new construction of a definitely shaped matter, which in some mysterious way will acquire, by the new combination alone, some new function, a function distinct from anything implicit in the elements themselves,—all it has to do is to admit to consciousness some part of life previously excluded, making the new form of activity unconscious of everything which might distract it from the new purpose. Evolution can proceed thus because consciousness and life are universal reality, an activity within which and of which we are centres formed to effect actions; because reality is not a static, inert sphere of activity, independent of us and limiting us; because in consciousness we are not aware of something opposed to us and independent; because, in short, mind is energy, not stuff. It is our restriction

to definitely formed actions which gives to nature its objective aspect.

From this concept of mind-energy there follows naturally a new concept of knowledge, and with it the problem of knowledge, as it has been presented throughout the controversy between realist and idealist, is completely transformed. It is clear that if we conceive life itself as reality, consciousness as identical with life, and unconsciousness as the positive means by which life brings about its concentration in individual acting centres, then discernment of an independent reality is meaningless, and the faculty of knowing cannot be a faculty of contemplating and discriminating alien existence. The problem of how we come to know an independent objective world of nature, and the sceptical dilemma in regard to it, disappear. A new but entirely different problem arises, and at least this new problem is not foredoomed to sterility by the very terms in which it has to be stated. The new problem is to discover how and why the enduring, unceasingly active reality, life, is focussed in individual centres, and by what means and for what purpose the aspect of a reality essentially fluent is made to appear that of a static, immobile, alien, opposing reality. It hardly needs pointing out to any one familiar with the direction of recent physics that this problem is not purely metaphysical; it has an important and intimate relation to physical science. I think the best way in which I can present this new working principle is by taking as the illustrative example of it Bergson's scientific analysis of a psychical phenomenon which he names " Memory of the Present and False Recognition " (*Mind-Energy*, p. 109). Recognition offers one of the most obstin-

ate problems in epistemology, as every one familiar with the history of theory of knowledge knows. In a sense indeed the whole of theory of knowledge is concentrated in it, and could we propose a really satisfactory solution of the problem of recognition one chapter in the history of philosophy would be closed. Recognition is what gives to present perceptual experience the feeling of familiarity which accompanies it whether it be routine or entirely novel. The feeling admits of varying degree, but were it entirely absent consciousness itself would disappear. Recognition, when we analyse it, seems a complex thing—the association of a present fact with a present idea of past fact. The association is not arbitrary as in constructive imagination, but appears as dependent on some actual relation between the present fact and the past fact ideally present. The laws of the association of ideas have therefore occupied philosophers from the beginning of philosophy. They are supposed to rest fundamentally on the objective fact that there is resemblance between past sense experience and present sense experience, and on the subjective fact that memory of past experience is retained in consciousness in an ideal form. Recognition therefore is generally regarded as an act of comparison comprehending a judgment so rapid that it enters consciousness as an immediate association. But what is common to every theory of association is the distinction between perception, which is fact, and memory, which is idea. We have, that is to say, perception of the present and memory of the past, and the opposite notions, perception of the past and memory of the present, are a paradox. Both these paradoxical notions are declared by Bergson to be fact, and they are

paradoxical only because we fail to understand what the past and the present are. But Bergson is not content to expose logical fallacies or to play with dialectic. Construction which is purely metaphysical is, he says, "usually a fragile thing" (*Mind-Energy*, p. 58). He is never satisfied with any theory unless he can bring to its elucidation some concrete fact of living experience. This is what he attempts to do in the essay to which I am referring.

The false recognition which is analysed is not a mistaken resemblance but a distinct phenomenon which has been described and verified and carefully recorded by psychologists, many of them medical practitioners. It is not an uncommon phenomenon, neither is it necessarily symptomatic. Many people can testify to having at some time experienced, generally very briefly and under exceptional conditions, something closely analogous. The phenomenon is that the person seems to himself to be remembering what he is actually perceiving, so that he is bewildered with the feeling that he is going through what he has already gone through, that his present experience has nothing new in it, that he knows it already. He feels that he has seen what he is seeing and not that he is seeing what he has formerly seen. He has memory of the present instead of the normal memory of the past. If we accept the ordinary concepts of perception and memory and the ordinary concept of reality on which they are based, we shall see no more in this phenomenon than a curious instance of a strange delusion. In the light of the concept of mind-energy it becomes at once significant. Suppose our knowledge and its modes have been brought into being by the needs of our activity, fashioned by

the evolution of contrivances and mechanisms which canalize the impulse of life, then it will be in cases like this where, owing to derangement or miscarriage, the mechanisms are out of gear, or where the contrivances are breaking down, that we shall expect to find the significant facts which may give us a glimpse of their real purpose. It is here we must search and here we may find the opportunity at least to test our theory.

The argument of Bergson's essay is careful and long and I do not propose to follow it or to criticize it. Indeed in order to do that to any purpose one would have oneself to test cases. Its value to me is illustrative. If the new concept be true, then the phenomenon is one which exactly accords with it. If the past exists in the ordinary and absolute meaning of the word; if we can say "There it is" in the non-spatial meaning of the adverb; if our history or duration be one continuous living action making itself; and if at each moment of the progressing action something is being added to a past which is carried along in the action and belongs integrally to it; then it is clear that at each moment of living experience the memory-form as well as the perception-form of reality is being created by the mind. Now suppose that the normal attitude of the mind is to be straining forward, to be anticipating, and that this attitude is kept constant by means of a mental mechanism which automatically throws the past into oblivion, which brings about a continuous forgetting—a forgetting never absolute, for that would defeat the end, but delicately adjusted as an instrument of selection; then should we not expect that a first consequence of mental estrangement or abnormality would be a confusion of memory and

perception? In Bergson's view we actually find this in the phenomenon of false recognition. The enfeeblement affects the attention to life and the first result is that the power of throwing the past into oblivion as it is created, or, to put it in objective form, the power of the progressing action to fall behind and out of view, is deranged, the person loses the sharp distinction between past and present, or even experiences the present as past.

The particular application, of course, may or may not be true. Even Bergson himself would claim for it no more than an approximation. What I am concerned to emphasize is the richness of the new concept and the utilizability of the new principle. First, then, let us see what is the fact in experience to which Bergson appeals as the ground of the new concept of reality. It is memory — not theory of memory, but the obstinate fact of existence which memory compels us to recognize. This fact of experience obliges us to substitute duration for extension as the substance of things. Duration is fundamentally psychical. Only what is psychical endures. Translate duration into physical terms and it becomes transformed into time, into something which is not duration but a different thing, succession. Time in the sense of succession is a dimension spatially conceived, *i.e.* it is not duration but extension. Extension is not absolute, it is purely relative to tension. Duration is absolute, it is the actuality of activity. It includes and conditions activity. Duration means that the past is present; that it is not non-existence; that it is not only present in the attenuated shape of more or less dim traces or recollections of what has been, but actually present as the very substance of

activity, continued in and determining the forming action. It is the fact of memory which reveals the utter insufficiency of the old concept of a static reality. The concept of physical reality, of a matter occupying space and changing its relative position by the succession of its states in time, is essentially discrete. Space and time as principles of continuity are external imposed conditions. In consciousness alone have we the pure fact of duration, and memory is a fact of consciousness. If the universe endures, it must mean that it is not an aggregate of discrete momentary existences, but that it lives; that its reality is not matter but history.

Let us now consider the working principle which this new concept puts in our hands. The key-note is the identity of life and consciousness. Unconsciousness even when it appears to be complete, as in the plant, is a positive acquirement. By means of it life, which is consciousness in its essence, canalizes its activity. The most forcible illustration of the theory is the human intellect. The intellect is not an endowment which enables us to discriminate the nature of reality and discover truth, it is a mode by which the life impulse, working in us, narrows and restricts us to the particular aspect of reality which favours our activity. It gives the distinctively human form to human actions. Matter is the aspect it presents. Matter is an arrest of change or movement. This arrest is purely relative to our actions and it is the intellect which accomplishes it. The mode of its working is selection and the means of selection are contrivances to secure unconsciousness.

VII

BERGSON'S THEORY OF MEMORY

Memory is generally held to be the mental power of retaining the perceptions received through the senses, and of recalling them, after they have passed away or been displaced, in the form of images, which are more or less vivid and faithful copies of the originals. Perceptions are thought to come from a real world, or at least to bear witness to a reality independent of us and external to us. Memory is thought to be a kind of secondary thing, a copy, or repetition, or echo of sense perception. Memory, therefore, is thought to exist only as a state of consciousness, and to inform us of what was, not of anything that now is. The object is thought to be the same whether it is before the mind as a perception or as a memory-image, and the only difference to be in the mental acts of perceiving and remembering. This very common opinion of the nature and function of memory is in Bergson's view wholly false, and responsible for much confusion in philosophy and psychology. Memory is our power to know a reality different in kind and not merely in degree from the reality we know in external perception. The reality memory reveals is the register or record of our past experience which is present in our mind, even when we are entirely unconscious of it. In

external perception we become aware of some part of the physical universe in which we are acting, and in remembering we become aware of some part of the experience which constitutes our personality. In each case there is a present reality of which we become aware.

It may seem that it is not a very important matter which of the two views is true. "Things remembered," a man may say, "are past events, and whether I carry with me a register of them in my unconscious mind, and now and again turn my mental vision on to this register, or whether memory-images exist only when I am conscious of my past perceptions, in either case the result is the same: I know past events." Probably, too, the theory of a register of past events existing in an unconscious mind will seem an altogether gratuitous hypothesis to account for facts which have always seemed easy to explain. But this is because in our normal experience perception and memory are so intimately and immediately related that we find it impossible to fix a dividing line between them. Each seems to pass by imperceptible degrees into the other. This is not the case, however, in abnormal experience, and it is in its relation to the study of abnormal psychology that the importance of the theory is being recognized. It establishes, if it is true, the fact that there is a reality which, in distinction from what the physicist calls matter, we may call spirit. This reality exists in its own right, and subject to its own laws. The doctrine declares that there is a substance or reality of mental phenomena just as there is a substance or reality of physical phenomena. The theory is not a hypothesis, more or less plausible, and possessing a reasonable amount of probability; nor is it a doctrine

based upon concepts, and supported by dialectical arguments; on the contrary, it is a theory which can be submitted to the test of experiment and can appeal to the direct evidence of scientifically established fact.

The best way to approach the problem of memory is to consider it first from the side of physiology. There can be no doubt that the organ which is concerned with all the intellectual processes—perceiving, remembering, choosing and willing—is the cerebrum or great brain. The proof of this is established by experiments in physiology and by the study of comparative anatomy. Our knowledge of the minute structure of this organ has been largely increased in late years by the formulation of the neuron theory. A neuron is a distinct unit, leading its own independent life, connected functionally, not structurally, with its neighbours, connected also by nerve fibres with a sensitive surface or a muscle. Each neuron has a cell body from which branches extend. The branches of distinct neurons clasp one another without actually joining at what are named synapses. We are able, therefore, to picture the neural process as occurring very much in the manner of the passage of an electric current through a circuit in which there are interposed resistances. The resistances are at the synapses, and these must act something like the glow lamps on an electric-light installation. We suppose, therefore, that the neural process is the propagation of a vibration received at the sense organs as a stimulus and ending at a muscle, the contraction of which gives back the movement to the external world. All variety is due to the immense diversity of the paths which may be followed, the choice of which will determine the

resulting action. The process is purely physical and quantitative, and theoretically calculable from beginning to end. The psychical process which it seems to occasion is, on the other hand, qualitatively distinguished. It begins with a sensation located in a sense organ, becomes a perception, then a desire or volition or conation, ending in a purposive action.

The structure of the nervous system leaves no doubt whatever about the function in one important respect. It is clearly not contrived for the translation of material of any kind whatever from one part of the system to another, as are, for example, the blood-vessels; it is contrived solely for the transmission of movement by the propagation of vibrations. This fact, while it leaves unexplained the affective character of the psychical process, seems positively to invite a mechanical explanation of memory. If we suppose that perception is in some way generated by the propagation of a stimulus through the neurons of the cerebral cortex, then, if we also suppose memory to be the retention or recall of perception, the physical analogy fits the theory exactly. If a movement is propagated in any medium against a resistance, the path it makes for itself will leave its trace behind in the form of a weakened resistance along that path.

Memory, at least in its origin, may, it is supposed, be nothing more than this. However mysterious be the arising of a perception in the mind when a vibration passes through the brain, if this is what takes place, and however difficult it be to derive from simple movement the quality of sensation, yet the mere fact that the stimulus is actually making its path, overcoming a present resistance, will account for its vividness and for the feeling of present actuality. But,

granted perception, memory, it seems, need be nothing more nor other than the trace of this path, the faint copy of the original which is revived when the path is travelled anew. Or if it be more than this, if we suppose the perception to leave behind not only a weakened resistance at the synapse, but also an actual impression on the neuron, this will light up as memory when the neuron is stimulated anew.

It is by a physical analogy of this kind that memory is almost invariably explained. We think we see practically an identical phenomenon in the gradual loss of resilience in a steel spring or in the altered disposition of the molecules of a metal bar subjected to strain. And when all physiological process is dropped out of account, and our attention is directed solely to psychological conditions, even then memory seems to possess nothing in its own right, to be only the ghost of what once had flesh and blood. In consequence the problem of knowledge has always been pre-eminently the problem of the nature of our perception of the external world; the problem of memory has seemed altogether secondary. And whatever the nature of external perception has been thought to be, whether actual discernment of an independent order of existence, as the realist supposes, or an entirely ideal or mental existence, as the idealist supposes, it alone is original and memory derived, a difference only of degree.

Let us for the present continue to set aside any questions of a purely psychological kind arising out of the nature of perception and memory, and consider what physiology can show by experiment to be the manner of working of the organ itself, and also what we can learn, by comparative anatomy and the evolu-

tion of the present form of the cerebrum, of its function and of the end or purpose of that evolution.

It is not open to doubt that the development of the frontal hemispheres of the brain in the evolution of vertebrate forms has been accompanied by an increase in intellectual and rational life, and it is commonly held, therefore, that we have in this structure pre-eminently the organ of intellect, the purpose of which is to enable the creature to be conscious or aware of itself and its environment, to know. The brain is therefore regarded as beyond all else the organ which enables living creatures to contemplate reality. Contemplation leads to speculation, and so the creature is raised by this organ to an altogether higher plane of existence—the life of reason. If then we follow out this view, the chief work of this higher organ of the brain will appear to be the receiving of impressions from the outer world, and the conversion of them into an order which represents ever more and more perfectly the order and reality of the universe. Consequently, in the evolution of the organ from its rudimentary beginnings in lowly creatures we trace a gradually improving power of receiving and using revelations of external reality. This function of the brain seems then to be exercised in two ways: first, it receives a revelation of the external world directly by means of a stimulus conveyed to it; and secondly, it retains that revelation in a form which can be revived. This is the ordinary view. The brain may not actually create perceptions and memory, but at least it provides the conditions of their generation, this being its chief end or function.

The theory of Bergson is totally opposed to this view. According to it, the sole and only function of

the cerebral cortex is to provide the means to the living creature of controlling its actions, to enable it to give effect to its power to choose and will its movements. The brain is not even the condition of the existence of perception and memory; these are inherent in the life or mind of the creature. It is the organ which enables these mental faculties to intervene to control and direct the bodily action. There are therefore two views which may be held of the function of the cerebrum. According to the one, it has endowed us with the faculties of perceiving and remembering, and has for this purpose been evolved. According to the other, it has brought with it no new faculties, but it has enlarged the range of our activity by providing us with a contrivance which enables us to replace or supplement unconscious and automatic action with freely chosen and willed action. Perception and memory are in this view not the end or purpose of cerebral function, but a means to an end. They are the condition of free action.

Perception and memory are distinct psychical processes, but their relative importance is very different according to which of these views we hold. If the end or purpose of the great brain is knowledge, perception will seem to be its main function, and memory a sort of reflection, a power of retaining and reviving the perception in an attenuated form. If, on the other hand, we see in the brain the organ which admits a greater freedom and a wider range and scope to our bodily actions, then memory will seem immensely more important, and even more primitive as a psychical power, than perception. It is therefore very important to see exactly what physiology can teach us on this question.

Briefly, we may say that all attempts to localize perceptive or imaginative centres in the brain have failed. It does not follow that there are no such centres, but confident anticipations like that of Wundt that the apperceptive centre would be found to be localized in the forepart of the frontal hemispheres have received no support from experiment. The only localizations which have been successfully demonstrated are the motor centres which control the various muscular systems connected with face, joints, limbs, etc. And when comparison is made with lower and more primitive forms in the evolution of the cortex, it is seen that with the growth and development of the organ these motor areas tend to increase and become more differentiated, so that more and more muscles and muscular systems are subordinated to a higher control. For example, in the rabbit no centre in the cerebral hemispheres controlling the movements of the hind limbs has been discovered, but in the cat there has been. And everything leads us to suppose that in the evolution of the organ the more important movements connected with the head and special sense organs were the first to be represented, and that other muscular movements of the body and limbs have been added by a continuous development. When we consider that motor centres are more easy to detect than sensory centres, for the obvious reason that a muscular movement is observable while a sensation felt or image perceived is not, and further that experiments can be conducted only on anæsthetized animals, or on persons who are unconscious by reason of injury or disease, it is not surprising that the greater part of the cerebral structure is quite beyond our power to resolve into special functions, and no argument can

be based on our failure. It is quite another case, however, with regard to memory. If memory be dependent on the brain in the sense that the memory-images are preserved there in the form of impressions or dispositions—if, in fact, memory be in any way dependent on the particular form of the elements which compose the brain—it must certainly follow that particular recollections, being dependent on particular structures, will cease to exist when these particular structures are destroyed. Loss of memory in such case will not be merely the impairing or enfeebling of a faculty, it will be also the definite obliteration of particular images corresponding to definite injury of nerve substance. We can bring this hypothesis to the test of experiment.

Of the localizations of function in the cerebral hemispheres one has been established on the clearest evidence, namely, the centre which governs the movements of articulation connected with speech. It is located on the second convolution of the left temporo-sphenoidal region. Any injury to this region such as the obstruction of a blood-vessel, or any loss or deterioration of tissue due to accident or disease, manifests itself immediately in some disturbance of the faculty of using and of interpreting spoken words. The part we must suppose memory to play in the exercise of the function of articulate speech is of overwhelming importance. When we hear a person conversing, all that can actually be said to come to the mind from the world without the body is a continuous sensation of sound. Were no memory-images brought to consciousness by the sound, there would be nothing other than a more or less noisy blurr such as we seem to experience when we hear

persons conversing in an unknown tongue, or when we hear a confused murmur such as that of waves breaking on the seashore. Memory enables us to break up the sound, to decompose it into separate spoken words, to combine these words into the meaning of the sentence, and, by calling up an infinite diversity of associations, to give the words the meaning expressed in articulate speech. According to the first theory, memory is the impression left by former perception, and its recall to consciousness is due to the revival of the old impression by a new perception. If this be true, it is clear that destruction or injury of the brain structure will involve destruction or injury of the particular memory-images dependent on the part affected, and therefore in proportion to the extent of the injury will be the number of particular recollections extinguished. It is quite impossible in such case that the function of remembering exercised by the destroyed part of the brain can be taken over by some other part still intact, in the way, for example, in which we find that some organs of the body can take on, when required, functions usually exercised by others.

In the mental disorder known as auditory aphasia the nature of the malady in great measure turns upon the question whether particular cerebral injury does or does not involve the destruction of particular memory-images. It is a disorder due to an injury of the region of the brain in which the centres of control of articulate speech are situated. It does not involve deafness, there is no apparent loss of power to receive the sound sensations, but there is total failure to interpret them, to evoke the memories which they have usually evoked and which give them meaning. The words heard may be quite familiar, but the power

to understand them is lost. Here then we have a case in which brain injury affects memory, and memory alone. It seems at first as though just what on the ordinary theory we should expect to happen, does happen. It seems as though the word-memories must have been located in the injured part of the brain, and have consequently perished. The most careful investigation has failed to confirm this view. On the contrary, it is now generally recognized that the loss of word-memory is rather a consequence of the interruption of a cerebral function than the direct effect of the injury. What we have to deal with in aphasia is the failure of a particular part of the cerebral cortex to fulfil its function of continuing sensory excitation into co-ordinated motor reactions. There is a break in the circuit, throwing out of gear the special contrivance by which ideas are translated into actions, in this case the actions being those implied in language and speech. The mental control of these actions is dependent on the motor contrivance. Memory is not necessarily destroyed, but it is rendered useless. It is possible to show in many individual cases of this disorder that there is no actual loss of memory, but only an abeyance of its functioning. And, what is even more important in cases where there is actual loss of memory, it is never of the nature we should expect if it were due to destruction of brain tissue in which particular memories were preserved. We are not of course entitled to conclude that memory is not retained in the cells and fibres of the cortex. No argument of the kind could prove that. The most complete proof that the failing word-memories were still existent and only prevented from functioning would not show that their existence is independent of

the brain. It might mean only that the connexion with the region of the brain in which they reposed was severed.

But what the argument from aphasia proves convincingly is that when the neural path from the sensory stimulus to the motor activity is interrupted, memory, wherever and however it exists, cannot perform its function in action. This suggests a new theory of the nature of memory and of the end which memory serves, namely, the theory that memory, like perception, is the coming to consciousness of an external reality to serve the action in progress. Whatever part the mind plays in perceiving, or, if we suppose perception to be wholly due to cerebral process, then whatever part the brain plays in perceiving, the object perceived is reality outside the body.

In the argument based on our knowledge of the structure and function of the brain and the discovery of the localization of the areas which control the muscular systems, I have not raised the question of the nature of perception. I am concerned here solely with the question whether memory is the same as perception, only differing from it in the degree of its intensity, or whether it is different in kind, revealing another order of reality.

External perception reveals the physical universe. In the sensory-motor process a revelation from the physical universe of reality outside the process itself intervenes, and plays its part in shaping action. Our theory of memory is that it plays a part exactly analogous to that which external perception plays. In memory there comes a reality to consciousness which is no more already existent in the brain than the external universe is in the brain. But it is mental not physical

reality which then comes to consciousness. Such a theory is generally rejected summarily, because to say that memory exists in the mind seems either to deny its real existence altogether, or to place it in the brain, for there is nowhere else in the universe for it. The reply is that the physical universe, including the brain which is part of it, is spatial, but mind is a duration. The two orders of existence are entirely different, but equally real. The full meaning of this only appears when we consider the problem of memory from the standpoint of psychology.

Memory is the retention of the past. It is the record of the acted past of our experience which we bear along with us, and call to consciousness when occasion requires. The past survives in two forms. In one it is a record of what has happened in, or formed part of, conscious experience; it comes to consciousness as a memory-image, a recollection bearing within it the stamp of time and circumstance which make it unique. It is not a repetition of a past experience, but a recurrence to present consciousness of what in its very nature cannot be repeated. This is pure memory. We regard our whole experience as preserved in this way. Most of it is shut out in forgetfulness, much of it is useless, much of it is totally devoid of special interest, but any part of it might be, under favourable conditions, recalled to consciousness. The other form in which the past survives is in the motor dispositions, the habits, the tendencies to repeat, which we have acquired automatically in learning by experience, and also deliberately by attentive application. This is habit-memory. It repeats, but does not re-present, the past.

It is this habit-memory which we have in mind

when we regard memory as a function of cerebral process, and we do not distinguish it from the memory which is a recollection or re-presentation of the past. In habit-memory it is quite evident that we have a most complex and delicately co-ordinated system of sensori-motor arcs in the cortex, and also a ready formed disposition there to set the system in instantaneous operation when the appropriate sign is given. There are in particular two muscular groups which are specially subject to this intricate and minutely and delicately adjusted co-ordination. There are the muscles of the mouth, lips, throat, larynx, etc., which serve for articulate speech, and those of the hands, which serve for delicate manipulation. The centres which control these two groups occupy large areas of the cortex, corresponding to their importance in living action, but with these groups are co-ordinated also the muscles of every part of the body. Consider, for example, a skilful pianist giving a recital, and think not only of the innumerable separate muscles brought into play, each controlled by its neuron, but also of the absolutely accurate co-ordination of these movements required for the performance of the actions. And what is the action? It is the repetition of something which has been committed to memory. Memory of this kind is essentially linked to, and wholly dependent upon, the brain. Clearly any injury which destroyed or disarranged or prevented free passage over the sensori-motor arcs would have precisely the same effect as, if it did not itself involve, loss of memory. This is our theory of what happens in aphasia.

But what part does pure memory play? This is the crucial question. The acquirement of skill is possible because experience leaves a record, and the

record is available for the recall of images. The pianist has acquired his memory of the compositions he can now repeat by particular successive efforts, each of which had its place, time and special circumstances. Not one of these past efforts is necessarily present to him while performing, but each one is capable of recall at any time by adopting the appropriate attitude of recall. It is this pure memory which exists in the mind, and does not exist as a disposition or impression in the brain. It is as inconceivable that these recollections can be stored in the neurons, or at the synapses, or at any other part whatever of the mechanism, as it is that the physical world we perceive by the senses can be in the brain. The argument which would lead us to affirm the former would compel us to accept the latter. It is inconceivable that pure memory can be a record of cerebral movement because of the uniqueness and integrality of pure memory. If pure memory lies engraved in the neural substance, on what principle is it dissociated and rearranged to form the motor disposition of the skilful performer? By what process could successive but homogeneous movements in brain substance, if this is all there are, be broken up and sorted out into different compartments, and yet be also capable of recall as a single and unique record?

When this problem is really faced, it is seen that every psychological as well as every physiological fact points to the conclusion that in the brain we have a contrivance for the co-ordination of movements and nothing more. In every action an almost inexhaustible diversity and complexity of contracting muscles and of muscles inhibited from contracting are brought into unity. This is made possible by means of the

connexions and inter-connexions of the nervous system, and is brought about by the propagation of vibratory movements over sensori-motor arcs. This, and only this, is the work of the cerebral hemisphere. All that consciousness implies is the work of the mind.

The psychological difficulty in presenting this theory of memory lies in the fact that in ordinary thought we identify mind and consciousness. By our mind we usually mean our conscious processes of becoming aware of our own bodies and the surrounding objects with which they are in relation. We therefore contrast the mind as consciousness or awareness of things with the things themselves, among which our own bodily organism is included. We suppose these things to exist in their own right whether any one is conscious of them or not. There is no difficulty in ordinary thought in so representing the physical world. But if we try to suppose that as well as physical things there are mental things with an equal claim to be considered as existing in their own right, and independently of any one's consciousness of them, the notion seems self-contradictory. We can form an image of independent physical reality because we conceive it as spatial, but we fail to give any precise meaning to unconscious memory because there is no place it can occupy to the exclusion of other things, and any reality which does not itself occupy space must, it seems to us, be only an attribute or quality of something which does. It is worth while to examine this difficulty closely before attempting to present the theory.

Every one recognizes that the mind is a real thing, and no one supposes it is a material object. When we speak of a man's mind in distinction from his bodily

presence, we mean the range of his experience and the character of his actions. Each of us is individual in his memory and in his character, and these constitute personality. Mind therefore seems to be experience, and experience to be consciousness. But then it seems to us that consciousness may easily be conceived as the attribute of a material thing, or at least be a phenomenon which arises when certain conditions—such, for instance, as the cerebral processes—are fulfilled. Consciousness, we say, is just awareness, and given certain conditions of organization, why should not any material thing be able to be aware of another material thing? We suppose then all real existence to be independent of consciousness, and to come to consciousness on occasion. Consciousness, we say, is a relation of awareness which in no way affects the nature of the reality of which we become aware. Whether or not such a view is philosophically tenable, it clearly shows that common sense finds no difficulty whatever in the notion of existence in the unconscious; it is the ordinary notion of existence. But this only applies to the order of reality which is spatial. It is space which confers on an object the right to exist unconsciously. This most important distinction is generally unnoticed, so accustomed are we to regard spatial reality as the only reality. But there is also a temporal order, and from the point of view of objective reality, this temporal order has every bit as much claim to be independent of our awareness of it as the spatial order. A living creature not only occupies a definite area of space and may become aware of what is occupying the surrounding area, but also it endures for a definite period of time, and may become aware of before and after. Each action is a

time-process uniting past and future in the action's progress. But while we imagine we may be directly aware of spatial reality, we are unable to conceive any way in which we may become directly aware of temporal reality. Consequently we distinguish two modes of consciousness: one, perceiving, the other, remembering or imagining. But with this distinction the simplicity of the knowing relation is gone for ever. For one great order of reality, the succession of events in time, knowing is not direct awareness, but an awareness mediated by certain spatial marks which we interpret as signs of a temporal order. Memory is not awareness of really existing duration, in the same way that we suppose perception to be awareness of really existing extension; it is a recollection of what has ceased to exist.

The theory of pure memory restores the simplicity of this knowing relation. It denies that there is any difference between perceiving and remembering as modes of consciousness; the difference lies wholly in the kind of reality which is brought to consciousness. Memory exists when we are not aware of it. The memory-image is not created either by the mind or by the process in the brain; its coming to consciousness is our discernment of it.

What evidence have we that there exists in mind an integral record of all that has happened in or formed part of experience—that memory exists actually, and not only potentially? In the first place, there is the common experience that we can attend to, and as it were travel over, our past in precisely the same way in which we attend to the material objects surrounding us in space. We can narrow our view, focussing our attention on some single incident, or we can relax our

attention and let our minds take in whole periods. We can minutely analyse a past action, or we can leave our mind free for recollections to flow over us. This reality remembered has the same mark of independence of present consciousness as the reality perceived when we survey a landscape. We have no more power to alter, modify, or repress our recollections than we have to alter, modify, or repress our perceptions. If in the case of external perception we regard this independence of conscious activity as evidence of real existence, the argument is equally cogent in the case of memory. It is evidence of a reality which exists independently of the consciousness or awareness of it.

But more striking and more direct evidence is afforded by special cases which have been often recorded, and many of which are well authenticated. Persons resuscitated after suffocation by drowning or hanging have declared that, in the brief moments which separated their final struggles from the complete loss of consciousness, a vision of their whole past life appeared to them, seemingly in its integrity and as though it were being lived as a whole. One case in particular is laid stress on by Bergson, that of a person losing consciousness as he slipped over a precipice, because in this case no physiological explanation, such as the possible effect of the blood-poisoning which causes the loss of consciousness in suffocation, could be alleged. Bergson's theory is that in these cases the mind, at the moment of abandoning a hopeless struggle, is released from the forward-looking attitude which characterizes its activity, and, turned back on itself, beholds for a few brief instants the record or register of its past which is always with it, but shut out

from consciousness by attention to life. But whatever the value of the evidence in such cases, they prove that much of the memory of our past which seems irretrievably lost is still in existence. The integrality of experience which memory draws from is at least one of the things we mean by personality.

But the overwhelming evidence of a reality in memory independent of the immediate experience of it in consciousness comes from the discoveries of abnormal psychology. This evidence is accumulating, and it has already familiarized us with the conception of psychical reality existing in pure unconsciousness, and it is forming itself into a science of mind on a scale and with a command of material which have hitherto appeared an impossible ideal. We now know that what we experience as consciousness is an infinitesimal part of our psychical life, and that processes go on among psychical elements existing far below the plane on which our conscious actions are performed. Our sanity depends on the healthy functioning of psychical processes removed altogether from consciousness, as much as, and it may be even more than, on the healthy functioning of our physiological organs.

What then is the reality which memory reveals? It is not the past events themselves, but the register they have left in the living mind. Memory reveals spirit. There are therefore two orders of reality, different in kind—a material order and a spiritual order—over which our mind can range, and from which the images come which shape and frame our actions.

The doctrine has offered considerable difficulty to philosophical criticism on account of its apparently irreconcilable dualism. But we are dealing only with

a psychological problem, and the question of an ultimate dualism is metaphysical. This is abundantly clear when we take up Bergson's metaphysical argument in which the dualism of mind and matter is reconciled. In psychology we assume a mind opposed to a world which it knows. What, for the mind, is this world? We distinguish two faculties—that of perceiving and that of remembering—which we regard as mental acts. Are they only different ways of apprehending one and the same reality? That they are so is the commonly held view. On our theory the difference lies in the nature of the reality discerned, not in the mental act.

Our mind in action is focussed in an attitude of conscious attention to life. At every moment of an action in progress the mind is controlling and directing our activity by preparing and shaping the action. Consciousness is the luminous centre. It exists for the sole purpose of serving action. The brain is the contrivance by which action is co-ordinated, directed and controlled. It is a mechanism of marvellous complexity for the reception and transmission of messages, a kind of vast telephonic exchange. There is one point, and one only, in the propagation of a vibration through the brain at which the mind can effectively intervene to decide the resulting action. This is where the sensory and motor elements meet, where the sensory nerves pass on the current to the motor nerves, and it is because the mind intervenes at this point that it appears as though the process itself generated the mind. What, then, really is the mental process? It is perception and memory serving action, combining to form the eventual action. Two kinds of images form themselves in consciousness, perceptual

images and memory images; whence do they come? With regard to perception there can be no doubt. Whatever be the work of the mind on the data of sense, whether it be selection only, or whether it be the clothing them with form or the enclosing them in conceptual frames, we know whence they come. They come from the external world. Whether they arise within the body as affections, or without the body as external perceptions, they come from the spatial world, and not from the mind itself. But whence do memory-images come? They, too, come from an already-existing reality. The common expressions, " bringing to mind," " recollecting," " remembering," show this. This reality is the mind itself. It is not a spatial existence, but a duration. The mind is forming itself by the action it is engaged in. The living experience of incessant action is adding to the store of memory and forming the character of the action itself. The register or record is not something foreign to ourselves, some kind of spiritual stuff on which some process of photography is leaving the impressions of the scenes through which we pass. Our activity is a duration, and this means that the acted past is very part of our present activity. It is this part of ourselves which comes to consciousness in memory, and it is our very self, even when we are unconscious of it.

VIII

WHY THE MIND SEEMS TO BE AND YET CANNOT BE PRODUCED BY THE BRAIN

If an electric current is applied to the closed eyelids we have a sensation of colour, if to the ears, a sensation of sound, if to the tongue, or nose, a sensation of taste or smell. What is apparently one and the same stimulus applied to different sense organs gives rise in the brain to different sensations. It seems easy to explain this by what we know of the anatomy and physiology of the brain. When our sense organs are stimulated, the stimulus is conveyed by means of sensory nerves to the brain and there gives rise to sensation, the sense organs are sensitive to various kinds of stimuli, the stimulus to the eyes gives the sensation of sight, to the ears the sensation of sound, and so on. It seems then it must be the brain which gives the special character of our sensations to consciousness, for we have only to send the brain a stimulus through the optic nerve to get sight, through the auditory nerve to get sound, and so on, and this notwithstanding that the stimulus has in itself none of the things which we distinguish as sensible qualities. Since it is out of sensations that all knowledge is built up, for there is nothing in the understanding which was not first in

the senses, it seems to follow that our mind, that is, the power or faculty we have of perceiving, remembering and imagining, must be produced by the brain, that is, be an effect of some process or other that goes on in the brain.

But it is not only by experiments such as this that we make the discovery that there is a close and intimate relation between the mind and the brain, a relation which makes the mind dependent on the brain. In ordinary discourse we use the words brain and mind as interchangeable terms, because it is quite evident that where there is lack of intelligence there is deficiency in the brain, and where there is a high degree of intelligence there is a correspondingly high development of brain. The immense advance in recent times in our knowledge of the physiology of cerebral process serves more and more to emphasize the entire and absolute dependence of mind on brain, and particularly of the higher processes of mind on the development of the cells and fibres of the cerebral cortex. Physiologists tell us that there are the almost unimaginable number of something like 7000 million nerve cells in the brain of the newly born child, and these, which neither increase nor decrease throughout life, undergo a development of interconnexion by means of the branching fibres they send out in every direction. When through disease or malformation or any other cause this development is arrested we have mental deficiency or idiocy.

The brain is an organ of immense complexity and has a great deal more to do than only to turn stimuli into sensations. It is part of a complete nervous system and only a part of the brain is concerned in mental process. A nervous system, or something

which closely corresponds to it, seems to be a necessary acquirement of every living organism which moves freely; and its structure, however complex it may be in its higher development, is built up of a simple arrangement of cells and fibres which receive and transmit movement. Its function is to receive a stimulus and to transmit it to a centre where a responsive movement is prepared. The nervous system is therefore described as sensorimotor from the double function which it performs. There are two kinds of response to a stimulus—one immediate and automatic, the other conscious and willed. It is only those stimuli which are transmitted to the cerebral cortex, and only some of these, that give rise to consciousness; consciousness seems to occur just at the moment when the movement in the fibres reaches the cerebral cortex; some of these movements, not all, give rise to consciousness. If a movement gives rise to consciousness, it occurs when a stimulus reaches the cortex and before it passes from the brain to the muscles to issue in actions. There appears to be a power of inhibiting or delaying the response to the stimulus while consciousness lasts, and consciousness seems to have the function of giving us a choice of the direction which the response shall take.

Moreover, if we sever the connecting fibres between the sense organs and the brain, all sensation and all thought ceases. This seems to indicate that in some way or another the movements which pass to the nerve cells of the cerebral cortex are there transformed into sensations, thoughts and ideas, into what we group together and think of as a different and separate kind of thing and call the mind. And it seems impossible to doubt that it is the brain which produces the mind

and not the mind which produces the brain, because the brain is an organ which develops continually throughout life and performs a multitude of other functions besides that of turning the excitation of its cells and fibres into sensations and perceptions, a function which seems to be intermittent and only called into activity at definite times and in special circumstances.

Many people think that our nature is a combination of two realities, a soul and a body, and that the mind belongs to the soul, which is immaterial or spiritual, while the brain belongs to the body, which is material. If this should turn out to be true, or even if it should appear to be credible, it does not alter the fact we are considering. No one can produce for his own or for some one else's observation a soul independent of a body, or a body (that is, of course, a living body, —a dead body is merely inert matter) independent of a soul. Therefore those who hold that there are two independent realities have to admit that everything happens just as if processes in the brain produced feelings and thoughts in the mind of the soul.

Why should they not? Why should not feelings and thoughts be manufactured in the brain just as any effect is produced when its necessary conditions are fulfilled? May it not be the function of this wonderfully complex organ to produce mind just as other less complex organs produce the secretions which are necessary to the life of the whole? Is it only the subtlety and ethereal nature of the product which make it seem inconceivable that mind can arise from a material process? If so, is there more than a difference of degree between it and the marvellously effective substances secreted by the various ductless glands?

The brain is not a gland, but it is an organ of such complexity and perfection that it is impossible to conceive a limit to its power.

There are two objections which seem, to every one who has studied the problem, unanswerable. One is that it is impossible to explain anything as an effect unless we can regard it as strictly commensurate with the cause, and mind is not commensurate with cerebral process. And the second is that the consciousness which arises in connexion with cerebral process is not consciousness of cerebral process but of something which is altogether independent of cerebral process, something existing in a different space, it may be thousands or millions of miles away from the brain, and something existing at a different time, it may be ages before or even after the present moment at which the cerebral process takes place.

Let us examine each of these objections carefully. And first the objection that the form of explanation we call cause and effect, and which is the form of all ordinary and scientific explanation, will not explain the production of the mind from the physiological processes in the brain. There is no need to discuss any of the philosophical problems involved in the idea of causality—the question is simply one of fact. Is the relation of the mind to the brain one of those relations which can be explained as cause and effect? When excessive light falls on the retina, there follows immediately a contraction of the pupils and, if that is not sufficient relief, then a closing of the eyelids. We can analyse this fact into a series of events each mechanically determined by the preceding one. If we start with the light, we say that it communicates to the retina a molecular motion which is transmitted by the optic

nerve to the brain, from the brain by efferent fibres to the muscles controlling the iris and eyelid which, by contracting or relaxing as the case may be, cause the iris to close the aperture admitting light, and the eyelid to cover and protect the whole organ. We can pursue our investigation further—in fact, in either direction to any extent that we please. We can explain the mechanism of the muscles and the supply to them of their energy, the anatomy of the retina and of the nerve fibres and the nature of their function, or on the other side we may explain the excessive light as due to the solar rays and these as produced by the rapid movement of the molecules in the solar mass. We call all this explanation because we can translate every fact we deal with into a common term and state its exact equivalence (theoretically, of course) in that common term. The common term is movement. If throughout the whole series there is anything which cannot be resolved into movement, then that thing is not in the causal relation. Now suppose that while this event is happening I am conscious. I shall be aware of a painful sensation, aware of the light as a perception, aware of the sun as the object of perception, aware of the immense velocity of the movement of the molecules of its mass and the consequent propagation of waves of light as my conception of the nature of light, aware also of the response my muscles are making to the stimuli my sense organs are receiving as my effort or conation. This awareness forms a connected series, but it is not, like the physiological process, a series of movements, and it does not intervene in that series, it does not form a link in the chain of transformations of movement which I call causes and effects. The two series are quite independent as series, and

the physiological process I explain by the relation of cause and effect because I find in every state the exact equivalent measured in movement of the preceding state, but the psychical series I explain by association which does not include the idea of equivalence or of measurement. But the important point is this:—the whole of this awareness with all the association which constitutes it a connected series comes into existence at one precise moment of the physiological process and at no other. This moment is when the stimulus from the sense organs reaches the cerebral cortex. Therefore it seems that the awareness must be produced at this moment by the process, and yet it is impossible that it can be, because it is not equivalent to the energy received by the cortical cells at this moment, it does not change the form of that energy or intercept it or in any way affect the series, that is to say, not in any way which the physiologist can take into account. The physiological process is complete in itself and explained as a series of exactly equivalent causes and effects independently of the awareness which arises at one of its moments.

Let us now look at the second objection, which rests on the nature of what we may call the content of consciousness, meaning the reality of which we are aware in consciousness. Our body is a part of the universe and, like the rest of the universe, an external object to the mind. Awareness is occasioned by the various influences which affect the surface of our body. Every one of the things we are aware of, supposing of course that there are realities outside of us and that we are aware of them, is outside of the process going on in the brain. Even if we include this process as itself part of the universe, we are aware of it, not

immediately in its functioning, but reflectively in explaining to ourselves the function of the brain as an object independent of our consciousness of it. Whatever therefore is the nature of the processes going on in the cells and fibres of the cerebral cortex, it is impossible that we should be aware of a real world outside of the brain and also that that awareness should be produced or manufactured in the brain. If we really could believe that our mind was produced in and by our brain, that the brain cells manufactured it or constructed it out of movements sent to it from the skin and sense organs, we could have no assurance that we had any knowledge of reality or that there was any reality to know. We might of course suppose, as some philosophers in former times supposed, that God performs a miracle every time we know anything, and that our only guarantee that there is any world independent of our knowledge, or that our knowledge is of a real world, is our faith in God that He does not deceive us. But considered simply in itself and according to the rules we apply to all our deductions and inferences, if the mind is simply a product of the brain, it is then something potentially present in the brain or present in the materials supplied to the brain before it is actually produced, and this something cannot be what is happening outside the brain or what did or will happen outside the brain. It is not the process going on in our brain that we are aware of, but the process going on outside our brain; and although influences reach our brain from outside, and although the physiological processes are directly connected with the outside world by the sense organs, yet these influences are stimuli which cannot be conceived as translating anything, even images of things,

into the brain as a material out of which the brain might be conceived to produce the mind.

These two objections are, as I have said, unanswerable. The first may be summed up in saying that the chain of causes and effects in the physiological process of which the brain is the centre is complete without the intervention of the psychical process, while the psychical process of consciousness, though a connected series, is not a relation of effects to causes but of association of ideas which involves no conversion of energy. And the second may be summed up in saying that knowledge, if it is knowledge of what is outside the brain, cannot be manufactured inside the brain. It is admitted therefore, practically by every one, that consciousness is not an effect of process in the cerebral cortex in the same way that the responsive movement of the muscles is such an effect. The brain directly connects the response of the body to the stimulus received, but the consciousness which arises in the process is not part of the efficiency. Yet this consciousness is certainly not independent of the process, for if it is, why does it arise at one moment and at one moment only of the process? So it has been suggested that it may be an effect of a different kind, an effect which does not absorb energy or give out energy, but still a direct effect of the cerebral process. It is said to be an epiphenomenon, and is compared to the shadow which accompanies a moving body and which neither aids nor hinders it though invariably accompanying it, or to the phosphorescence left along the track of the lucifer match we have struck, a one-sided effect which cannot in its turn become a cause.

This theory was considered by those who support the materialist, or what is now more generally called

the mechanistic, view, to meet all the difficulties involved in the conception of the mind as an effect or product of processes in the body. We may grant at once that, so far as the first objection we have dealt with is concerned, the conception that the mind is an epiphenomenon of the brain is possible. It may be that there are after-effects of brain processes which, though the direct effect of physical movements and of the conversion of energy, are yet not themselves an absorption of energy and do not therefore become an actual calculable part of the causal chain. We could explain in this way why consciousness is not measurable in terms of physical movement, although a product of physical movement. Moreover, so far as consciousness is simple feeling, pleasure and pain, something without distinguishable content and purely an affection, the conception might suffice. But when we consider the real nature and content of consciousness,—the second objection—the conception becomes impossible to the point of absolute incredibility. Think what this phosphorescence must be and do! It springs up along the track of a wave or current passing through the centres and fibres of the cerebral cortex, and when it springs up we are conscious—of what? Of the passing nerve current? No. Of the fact that it has passed? No. Of the stimuli which originated it on the surface of the body? No. Of the direction towards the muscles which are to be set in movement? No. We are not aware of any of these things which are actually occurring, but of the world outside us, of the world outside the nerve current altogether, of other persons and of other things than the body and its processes, of things like stars infinitely distant in

space, of recollections, of thoughts of things which may have happened at a time infinitely remote from the moment when the passing current, which occupies a limited portion of space and occurs at a definite moment of time, gives forth its luminous trail.

This is the rock on which all those theories that derive mind from body split. We wish to derive a reality which is unconfined in space and unlimited in time from a reality which is limited to a definite portion of space and to a moment of time. Suppose we succeed, we are then in this extraordinary dilemma that the only actual fact is the brain process with its consequence, and therefore the reality we are aware of may be a pure illusion, for the fact cannot guarantee its independent existence, and yet at the same time our only knowledge that there is a brain process with this consequence is an inference from the reality we falsely suppose ourselves to know. The argument therefore is a vicious circle. How do we know that there is a world outside of our body of which the body is a part? Because a certain process has taken place in a certain portion of our brain. And how do we know that this process has taken place? Because we know that there is a world outside of our body of which the body is a part. Every one has heard the story which used to be told in derision of the Hegelian philosophy, of the German philosopher who preparatory to writing an essay on " The Camel " went into his study to evolve the animal out of his self-consciousness. The story used to end with the unnecessary information that he is there still. Not more impossibly absurd is the idea that our mind is a product, whether we call it epiphenomenon or whether we think of it as a substantial effect, of our brain.

There are other theories besides that of the epiphenomenon which have been proposed as an explanation of the necessary connexion of mind and body, but they come to grief on the same rock. There is the very attractive theory of double aspects, very attractive because it offers a direct solution of the apparent dualism. According to this theory there is only one fact, but it assumes two aspects, a psychical aspect as consciousness, a physical aspect as movement or brain process, just as the movement of the ship tossing on the rolling billows is the same movement which in the ship's cabin is felt as conscious experience. Then there is the mind-stuff theory, according to which there is a substance of which every mind is composed, a substance as universal as material substance, a stuff of which every molecule, atom and electron has its share. I need not go into these theories in detail, because it must be obvious that they will be confronted with the very same difficulty we have been examining, the difficulty of the nature of mind and consciousness, that it is awareness of reality not confined to, nor commensurate with, the physical process which accompanies it.

The difficulty is so great that most psychologists and philosophers seek a way of escape, and so they adopt a theory which seems to them to recognize the fact of necessary connexion without committing them to any theory as to its nature. This is the well-known hypothesis of psycho-physical parallelism. It is a theory first formulated in the seventeenth century. Leibniz illustrated it by supposing that a clever artificer had designed two clocks whose movement and appearance might differ, but each of which kept perfect time; they would always synchronize, and

by reading one clock one could always know the exact condition of the other. So he supposed that God at the creation had made the mind and the body as two clocks which always kept time and therefore seemed as though the state of one was simply dependent on the state of the other. Now it seems to me that every one who adopts this hypothesis, whatever be the form he gives it, neglects two very important facts. The first is that the hypothesis goes far beyond anything justified by experience; it is much more than a mere admission of facts. Experience tells us that a physical process always accompanies a psychical process, but parallelism tells us that there is a one-one relation between the physical fact and the psychical fact. If it does not imply this, it is not parallelism but merely a fact which no one denies, that there is a constant relation between the psychical and the physical. And the second is this, that so far from its being a non-committal hypothesis it is the distinct adoption of a metaphysical theory.

The difficulties of every form of psycho-physical parallelism have lately been very generally recognized, and there has in consequence been an attempt to restate the doctrine of interaction in a form which does not conflict with the scientific law of the conservation of energy. Interaction supposes that the mind actually supplies energy to the body and that psychical reality undergoes conversion into physical reality. It is clear therefore that the first, rather than the second, of the two difficulties we have stated is the real stumbling-block to this theory. To overcome it the hypothesis has been suggested that there may be in every case of conscious action a conversion of energy which exactly compensates itself—a simultaneous con-

version of psychical into physical energy and of physical into psychical energy, so that the amount of each remains always constant. If this is the last word of interactionism, then it seems to me to offer us only a choice of evils. It is possible, in the sense that it avoids the actual absurdity of parallelism, but like parallelism it is a metaphysical theory which goes far beyond any known facts of experience and which throws no light whatever on the facts.

The fact which we have to recognize, and which there seems to be a natural disinclination in the human mind to recognize, is that mind and brain are absolutely incommensurable. They are two realities which meet —that is certain, for we never have one without the other—but they meet, like the circle and the tangent, at one point only. What constitutes this difference and why is the incommensurability absolute? The brain is material and therefore spatial, it is a certain disposition of material elements. This disposition of elements changes, but only externally by influences which affect the disposition and not the elements themselves. It is a delicate organization easily thrown out of balance or destroyed, but what is essential to its existence is material organization. On the other hand, mind is not spatial but temporal, its essential nature is a duration which conserves the past in memory. Imagine that an instantaneous cut is made across the whole of extension. The brain is there but not the mind, for we are imagining extension without duration and mind has no extension. Imagine on the other hand a section through the whole of duration: the mind is there but not the brain, for matter only exists simultaneously in a present; we cannot imagine matter without extension. The mind is therefore

essentially a time continuity and the brain essentially a space continuity. Restrict the mind to the actual condition of the brain at any given moment and there is no mind. Cut off from immediate perception all memory and imagination and there is no perception. Theoretically all that there is to perceive in the present is there, but without memory and imagination it can have none of the content or meaning that mind gives to it. On the other hand, the brain can have neither memory nor imagination; for all that it is, it is at every moment. In this lies the true reason why we cannot think that brain produces mind; it would be imagining that space produces time. It would mean that a purely material thing creates memory and imagination. We cannot escape the absurdity by supposing that the brain does not create the memory but preserves past impressions and ideas in nerve cells or nerve tracks and sets them free or revives them in response to stimuli. It would be easy to show that the same contradiction we have been examining before follows us here, but it is enough to say that such a theory can adduce no facts in its support. There are, however, many facts which seem to contradict it. One of these facts is very remarkable, and of especial interest, because it forms the basis of the theory of memory expounded by Bergson in *Matter and Memory*. It is the discovery some years ago, confirmed by every case since observed, of the nature of the malady known as auditory aphasia, a malady in which the patient, while still retaining the sense of hearing, has lost the power of recognizing the meaning of words. He seems to have lost his memory, to have forgotten what words mean, without having lost the power of recognizing the things themselves. This malady is accompanied

by a lesion of a particular region of the brain, one of the frontal convolutions well known and mapped out by anatomists. The discovery was the first, and also it remains the only successful, localization in the brain of a particular form of memory, that which we call recognition of words. It seemed at first to confirm the generally held opinion that there are special cells in the brain whose function is to store memories, and it was supposed therefore that the injury involved the destruction of a group of cells in which a particular kind of memories was stored, with the consequent result that the memories were destroyed, and that therefore according to the extent of the lesion was the amount of irrecoverable loss of memory. Bergson was the first to show that the facts pointed to an entirely opposite conclusion—that the memory was still in existence and unimpaired, but that what was thrown out of gear by the injury was the mechanism by which memory inserted itself in action. It was not a psychical reality but a motor mechanism that was affected. This view is now generally adopted; but even those who do not accept it, no longer quote aphasia as proving that psychical reality is produced by or stored up in material structures.

If we recognize this fact that in mind and brain we have two realities incommensurable by their very nature which function only in union with one another, we may understand why everything happens just as if the one were produced by the other, why when the Titan cleaves the head of Zeus the fully armed Athene springs into existence. To understand it we must see what it is that consciousness does, the purpose it fulfils. What we call consciousness is not the whole of mind. If it were, if part of mind were

not always something of which we are unconscious in exactly the same sense as that in which the material reality we perceive is always a part of a reality we are not perceiving, then the arising of consciousness at a particular juncture would be as inexplicable a miracle as that of the sudden existence of the fully armed goddess. The union of mind and body is in action. When we regard the facts from the standpoint of action, the main difficulty in regard to them disappears. We can see the part the brain plays and the part the mind plays as clearly as we can see the part the senses play and the part the muscles play. First of all we see why there must be union, because without the body, the mind, whatever it is, whether or not it is a separate as well as a distinct existence, can do nothing. The body is the instrument of the mind's activity. And without the mind the body is the blind play of physical forces. Take them in their union and we see that the brain is a great exchange office or switchboard, where the stimuli that come from the outer world are received and switched on to their responsive movements. We see also what the mind is: it is the whole scheme of our activity, and we see how it functions by bringing the field of our activity to consciousness. The stimuli received become affections and are perceived, and memories give meaning to perceptions, and delineate prospective actions and so direct the response. It is therefore at the particular instant in the process when the stimuli from the senses reach the cerebral cortex and before they issue in actions that consciousness functions. If it is to serve action it is only at that instant that its service can be effective. Naturally therefore it seems as if it is the functioning of the brain at that instant which produces the mind.

This, then, is the answer we give to the question why it is that the mind seems to be, and yet cannot be, produced by the brain. The mind guides and controls what the body does, it directs the body's actions. There is only one point at which control of action can be effective, and that is where the responsive movement of the body to a stimulus received is initiated, that is in the cerebral cortex. Because the mind is acting there it seems to come into existence there. This is our reason for saying that everything must happen just as if the mind was produced by the brain. But the mind is a reality of an entirely different order from that which alone can be produced by physical movement or by the material disposition of such things as atoms and molecules. This is our first reason for saying the mind cannot be produced by the brain. The brain is a certain group of material particles, or a certain equilibrium of physical forces, occupying a definite position in space, which responds to movements by transmitting movements. The mind is a continuity of time, a duration, a perceiving of what is outside the body, a remembering of what is over and past, an imagining of what is not yet. None of these characters are spatial. This is our second reason for saying that the mind cannot be produced by the brain.

IX

BENEDETTO CROCE

The Italian philosopher, Benedetto Croce, is intensely national. He is not merely Italian; he is a Neapolitan, and he prides himself on continuing the historical traditions of a line of modern philosophers, citizens of Naples, distinctive in the purpose and direction of their speculation, and linked up by the Renascence with the old classical learning. As it is essential to an understanding of Croce's philosophy to appreciate his claim in regard to his predecessors, I will begin with a brief account of them.

The modern line begins with Giambattista Vico (1668–1744). A great part of Croce's work has been directed to a revival of the study of this philosopher, whose *Nuova Scienza* he regards as the first clear indication and adequate expression of the modern philosophical problem. Vico's "New Science" is history, and history is for the first time consciously conceived as identical with philosophy. Vico is a writer who requires an interpreter, for his thoughts are clothed in bizarre imagery, and his world-view is moulded by Scripture, classical literature, and ecclesiastical tradition, as these were understood and interpreted in the pre-critical period, but the original ideas concealed beneath this strange garb are not only

brilliant but illuminating. Vico's contemporary fame rests on his discussion of the Homeric question, in which he argued that the authorship of the poems could not be attributed to one historical person. This formed no part of the original *Nuova Scienza*, but it was introduced into the second edition. The philosophical originality of Vico was, according to Croce, the discovery of the aesthetic nature of what the Cartesians had rejected as obscure and confused ideas (that is, the products of sense and imagination as distinguished from the clear and distinct ideas, the product of intellect) and his perception of their place as a moment in the development of mind. It was brought out with great force and splendidly illustrated in his theory that poetry, not prose, is the original form of human language.

There is a very remarkable analogy between the attitude which Vico adopted to the science and philosophy of his age and that of Croce in contemporary philosophy. The keynote of Croce's *Filosofia dello Spirito* is identical with the keynote of Vico's *Nuova Scienza* inasmuch as each indicates the same consciousness of a false and a true direction of philosophy. I may put it crudely as the conception that a philosophy of mind is of necessity a science of history. There was intentional irony in the title of Vico's famous book, *La Nuova Scienza*. The irony was directed at the prevalent and fashionable Cartesianism which, strangely belated, had suddenly invaded the intellectual society of Naples. It was talked about everywhere as "the new science." "The new science," he said scornfully, "is very old stuff. What is it but a revival of the exploded notions of Lucretius, Epicurus, and Democritus? 'Give me matter and motion and I will create

a world,' said Descartes, and is not this precisely what those old materialists and atomists pretended to do?" The *new* science is history—history not as a dry study of records of dead facts, but as the living revelation of mind, mind as it is expressed in the lives of individuals and of nations. And in Croce also we have an almost scornful rejection of the claim of the mathematical and physical sciences to be philosophy. These belong to the practical sphere, and are appraised for their utility; but they are for ever disqualified, by their abstract nature, from contributing to the understanding of that essentially concrete universal reality, *Lo Spirito*.

It is to a writer nearer our own time, however, that Croce attributes the direct influence which determined him toward philosophy. This is the Neapolitan patriot, Francesco de Sanctis (1817–1881), author of the *History of Italian Literature*. From De Sanctis there is no doubt Croce derived that consciousness of the intimate relation of literary criticism to history and philosophy which is characteristic of all his work. Croce had no personal relationship with De Sanctis, who retired from public life in 1866, the year of Croce's birth. Croce became an ardent reader of De Sanctis in his school days, and it was under this influence that later, while attending lectures at the University of Rome, he read Vico's *Nuova Scienza* for the first time and conceived the central idea which took full possession of his mind and became the active incentive of his philosophy, the idea of recombining the problem of history with the problem of art.

Croce may be said to have been in a manner born into a philosophical inheritance. The two distinguished philosophers, the brothers Bertrando and Silvio Spaventa, were his father's cousins. Bertrando

Spaventa, a famous Hegelian philosopher, lectured to large audiences at the University of Rome, and was the author of important treatises. He was a priest, and his philosophy, as we should expect, was of a decidedly theological tone. The brother Silvio was a politician and political philosopher, and his house at Rome was a centre of the political circle of the capital. Croce tells us that there was estrangement between his father and the Spaventas, but it had at any rate been to some extent overcome, for Croce's father had arranged that Silvio Spaventa was to be his son's tutor, when a terrible calamity altered the whole aspect by closing the period of the paternal home. In the earthquake of Casamicciola, in 1883, Croce's parents and only sister were killed. Benedetto and his only brother were rescued, he himself having lain half-buried, he tells us, several hours in the debris. He was received into Silvio Spaventa's home, and he and his brother became thenceforward members of that household. At the University of Rome Croce attended the ethical courses of Antonio Labriola, a famous anti-Hegelian (Herbartian) professor, and also became acquainted with the work of Bertrando Spaventa, reading his books and attending, as an unknown member of the crowded audience, one of his philosophical courses. The politicians who frequented Silvio's house, Croce tells us, had the effect of giving him a strong distaste for politics, and the reading of Bertrando's books turned him against Hegel. It is clear, however, that the whole tone and atmosphere of his philosophical study was Hegelian in the wide sense of the term, and the political philosophy which was the interest of Silvio Spaventa was concerned with criticism of the political Hegelians,

Marx and Engels. It is a curious and significant fact that while in North Italy the philosophical movement of the last quarter of the nineteenth century was positivistic, following Comte and the French influence, in Southern Italy it was strongly idealistic, following Hegel and the German influence.

Croce's philosophy in its principle and method may be described as a reform of the Hegelian dialectic. Of all his works, perhaps that which affords the most direct insight into his own mind is the essay entitled "What is living and what is dead in the philosophy of Hegel." Croce's idealism is as absolute as Hegel's. For Croce mind or spirit (what the Germans call *Geist*) is all reality, and reality is essentially activity. He would no doubt demur to the Hegelian formula "The real is the rational," but only in so far as reason is identified with logic. Logic in Croce's philosophy is a moment in the life of mind, not the whole of that life. Hegel transports us into a transcendental realm. We may be convinced of its reality, but we are never at home in it. The transcendental character never forsakes it; to dwell there requires a continual intellectual effort from which the wearied mind is constantly lapsing. The Hegelian philosophy therefore peculiarly conforms to the theological idea of transcendental reality and to the Christian conception of the spiritual life. In reading Croce, on the other hand, we never feel the otherness of the real world. The real world is that in which we effectively live. Reality is immanent in the world of ordinary experience and never transcends it. The world of thought is the world of being. We are even unconscious of a problem of transcendence. We meet no difficulty in conceiving the relation of thought and being; the difficulty would

be, indeed, to conceive a thought detached from being, a being detached from thought. For Croce there is no other-world above or below experience. What he analyses, criticizes and strives to bring from confusion to clearness are the problems of art, the problems of the moral life, the problems of the state, the problems of history. It is in this last respect that the contrast with Hegel is most marked. Hegel conceived a philosophy of history; Croce conceives philosophy as history. But it is a new concept of history that Croce gives us. History is not anecdotal, nor is it a chronicle of events, definite, fixed and unalterable, about which the only question is the accuracy of the record. Events in pure detachment from present reality are not the subject-matter of history. The whole meaning of history is the present reality unfolding itself in our lives. History therefore is not the record of what was, but the interpretation of what is. To the philosopher, history does not present an external matter to which he can be indifferent; history is the very reality itself which he studies. Kant has said in the *Critique of Pure Reason*, " Philosophy, unless it be in an historical manner, cannot be learned; we can at most learn to philosophize." Kant meant by the historical manner the history of systems; but his view that philosophy is not a body of doctrine but a method or way of trying to understand reality, that philosophy is philosophizing, is in complete accord with Croce's teaching. Croce would even say that to be a philosopher it is not necessary to have read the great philosophers, and he himself in his philosophical work turns for choice to the poets and historians rather than to the technical works of the philosophers. Croce's own philosophy is not a system but a series

of systematizations. It is not a metaphysic in the old meaning of a science of transcendental reality, because there is no transcendental reality to know. Philosophy is science of mind as universal, concrete reality.

It follows that for Croce there is no need of prolegomena, or of a propaedeutic, to the study of philosophy. It is natural to man. It may admit of degrees, it may vary in form, it may take shape in religious belief, in free speculation or in searching doubt, but it is a need of human nature that cries out for satisfaction; and, like all human needs, it is never satisfied. Philosophy is not the solution of a problem: it is rather the consciousness of a problem demanding solution.

On the other hand, this does not mean that Croce thinks we can as philosophers detach ourselves from the philosophical tradition—very far from it. History of philosophy shows us a continuous development, not in a straight line nor along a single channel, but an evolution of thought in which one aspect of reality after another presents itself for solution, its solution serving only to bring to light new problems. So it has always been, so we must expect it always will be, for in ceaseless activity the reality of mind consists. There are great stages in the history of philosophy, notable moments in the evolution of theory. If we confine ourselves to the Western development, we see a succession of achievements, each of which in solving a problem has brought new problems to light. Thus in the ancient world we have the nature speculations of the Ionians and of the Eleatics, leading to the discovery by Socrates of the nature of the concept. This discovery made possible, and at the same time pointed the direction and set the form to, the development of the Platonic and Aristotelian philosophy.

Again, in modern times we have Descartes, Spinoza, Leibniz, Locke, Berkeley and Hume, whose speculations on the problem of mind and matter, soul and body, and their attempts to give a consistent theory of human nature and its relation to divine nature, led to the discovery by Kant of the a priori synthesis, a discovery which has rendered possible the development of modern philosophy and determined its problems. Kant's discovery, whatever view we may take of it, is the basis on which contemporary philosophy rests.

Whoever would enter sympathetically into the study of the problems of philosophy as they are presented to us in Croce's writings must, as a preliminary, realize his conception of philosophy as the science of mind. It is a special meaning of philosophy and a special meaning of science. Croce is an uncompromising idealist, not in the meaning that he holds some particular theory of the nature of external reality, as that *esse* is *percipi*, or that there are no things-in-themselves. His idealism means that philosophy, the science of mind, is not one of the sciences with its place in a hierarchy, but is science of reality itself in the ultimate meaning and universal comprehensiveness of that term. Such a view of philosophy is not universally, nor even generally, conceded. Philosophy is usually regarded as a science of metaphysics, and metaphysics as a simple extension of physical science. The distinction between philosophy and the physical sciences is not, in the ordinary view, a difference of method; it is only a difference of subject-matter, the subject-matter of philosophy being peculiarly diaphanous and elusive. This is the standpoint of naturalism. According to this view the

sciences are arranged in a hierarchy based on the completeness and sureness with which various classes of phenomena and relations between phenomena are brought within complete systematic formulation. The most satisfactory are the mathematical sciences, and next to these the physical. The biological and psychological are more refractory, but it is supposed that this is due to the exceptional complexity of their objects. Beyond these there are the problems of the knowing relation itself, and the task of philosophy is simply to reduce them into the systematic order of a special science. The ideal of philosophy, so understood, is the scientific ideal of mathematical certainty and precision.

Very different is the idealist conception. For idealism the subject-matter of philosophy is not a class of phenomena, but reality in the comprehensive meaning of the term. It starts with living experience, not because this is a specially favoured object for observation, or that it offers a group of phenomena for classification, but because it is the insertion of mind in reality. It does not follow the scientific method of abstracting classes of objects and treating them as independently real. It does not distinguish acts of knowing from objects known. It accepts reality as an indivisible whole and studies it in its development or life. From the idealist standpoint mind does not stand apart from its objects. The objects of knowledge do not confront the mind as something alien. No relations are external.

There is no common ground between these divergent views of the problem and task of philosophy. To the naturalist, whether he admits it or not, the idealist's problem is essentially unmeaning. To the

idealist, naturalism is not philosophy, or, what is the same thing, when presented as a philosophy, is inherently contradictory.

Croce has written a great number of books. Most of them deal with problems of literary and artistic and historical criticism, but all of them converge on philosophy as their centre of interest. The philosophy itself is expounded in four independent volumes, together forming a connected series and constituting a survey of all the forms of mind, and grouped under the general title " Philosophy as the Science of Mind." The series consists of *Aesthetic as the Science of Expression and General Linguistic*, *Logic as the Science of the Pure Concept*, *The Philosophy of Practice*, and *The Theory and History of History*. The universal and concrete reality which Croce conceives as pure activity he names *Lo Spirito*. His English translator, Mr. Douglas Ainslie, has rendered this word uniformly " spirit." Here and in my *Philosophy of Benedetto Croce* I have called it uniformly " mind." It is the equivalent of the French *l'esprit*. It seems to me that a proper rendering of the term is essential for a right understanding of the philosophy. It is true that there is a tendency with us to use the term " spirit " without its usual transcendental meaning, but it is difficult to do so consistently. Croce means primarily by *Lo Spirito* the images and concepts of the mind—surely the English generic term for these particulars is " mind." But what to me is more important is that the term " spirit," however restricted, distinctly conveys, and " mind " does not, that very transcendental meaning which Croce so persistently deprecates.

Mind, which Croce conceives as universal and

concrete, is all-inclusive. In its nature it is essentially activity, not something which is active. The problem of philosophy therefore is not to discover its ground, or cause, or external principle, but to understand the mode of its manifestation. A self-centred activity is not moved from without, it develops from within, and the task of philosophy is to find the means of understanding the moments of its life, the degrees and stages of its expression. The science of mind is not to be confounded with the sciences of the growth and structure of the mind which constitute general and comparative psychology and anthropology. Those sciences are of the particular and abstract. The science of mind which is philosophy is the science of the active reality of which and in which we are.

The first great distinction which presents itself to us when we analyse the activity of mind is between knowing and acting. Mind is both a theoretical and a practical activity. The two characters are absolutely distinct yet inseparably united; each is meaningless in abstraction from the other. Mind is process. It never *is*; it is always *becoming*. Knowing and acting are the stages of this process, and their order is fixed and irreversible. Knowing is the condition of acting; acting is conditioned by knowing, and not vice versa. This stamps Croce's philosophy with the idealistic mark. It is the ground of his rejection of materialism. Every form of materialism makes the theoretical activity (knowing) posterior to and dependent upon the practical activity (acting).

Materialism supposes that there is some simple inert substratum as the basis of reality; it then supposes that there are degrees of complexity in the activity to which this substratum is subjected; and finally it

supposes that consciousness or awareness is the product of this activity to which the substratum is subjected. Idealism makes no hypotheses. It takes experience as fact and its reality as immediate and ultimate, and it studies this reality as an unfolding, developing life or mind. In this activity knowing necessarily conditions doing. Knowing is for the sake of doing, and doing has meaning only in so far as it is conditioned by knowing. In this distinction between knowing and acting or doing, Croce is of course offering us nothing original in philosophy; he is simply following the grand lines of philosophy as laid down in the Critiques of Kant. It is the distinction between the realms of the pure reason and the practical reason. Let us now see what is distinctive and original in Croce's concept of Philosophy as the Science of Mind.

The greatest innovation is the aesthetic theory. What is aesthetic experience? Aesthetic experience denotes a certain attitude of mind toward natural objects or works of art which makes us take pleasure in them and pronounce them beautiful; or, contrariwise, find displeasure in them and pronounce them ugly. Though this experience is common to all human beings, we recognize what we call a standard of taste and we think individuals attain it by culture—*i.e.* by self-discipline and progress in intellectual knowledge. At the same time there are some individuals who appear to us to attain it more naturally and more directly than others. These are the men of genius, the great artists, the poets, painters and musicians, who not only seem more sensible to beauty but also have within themselves the power to bestow it on the imaginative works, works of art, which they produce. So we consider art to be

the highest achievement of the human intellect, and appreciation of beauty in art to be essentially intellectual. We find nothing suggestive of this aesthetic activity in the biological series below the human, and in man it appears at the end of a long and slow intellectual evolution. The butterfly's wings, the peacock's tail, the gorgeous plumage of birds of paradise, and such-like phenomena, and also all the beautiful forms of vegetable and animal life, are beautiful *to us*, but are thought to have only a utility value for the creatures themselves—at least we do not attribute to them what we call aesthetic feelings. An aesthetic faculty seems indeed to depend on a power of detachment from mere gratification, and such a power seems attainable only where intellectual development is high.

Croce holds that in pure aesthetic experience there is nothing intellectual, using the term intellectual in the precise meaning of a logical reasoning faculty. Aesthetic is a distinct moment in the development of mind's activity, and a self-sufficient moment. It is the first and not the final stage of our full mental unfolding, and it is the stage which conditions and is not conditioned by the later stages. Man has two faculties, a faculty of imagination and a faculty of reason. By the first he gives expression to his intuitions in imagery, he produces images; by the second he relates those images and produces concepts. Without images there can be no concepts, but the image is not dependent on the concept. Together they complete the theoretical activity of mind. (I do not use the term "faculty" as explicative, but merely as descriptive.) Imagination and thought are not therefore two independent faculties brought together and united in the individual conscious activity; they are

the two stages or degrees of the theoretical activity of mind, and they stand to one another in the definite order that the first is the necessary condition of the second and the second is dependent on the first. They are the twofold degree of our theoretical activity—that is, of knowing. They correspond to the old division between sense and understanding, but instead of the concept of sense as purely passive receptivity we have the concept of aesthetic activity finding expression in the production of imagery.

It is difficult to realize the revolution this implies in the whole standpoint of theory of knowledge. The manifold of sense, the heterogeneous chaos of sense-data, or sensibilia, conceived as bombarding the cognitive mind, and accepted as the pure stuff out of which by some wonderful logical process, inherent in the mind, the world of conscious experience is constructed or else discovered, and laws given to nature —all this is banished as fiction. Reality is essentially and completely activity, and philosophy has not to start with a dual reality, knowing and being.

In aesthetic experience, then, mind is active and not passive. What is the nature of this activity? It has nothing logical about it. It does not reflect on experience, it does not judge it, does not classify or compare its data; it produces images, and the images express its own intuitions. This seems to throw us back on new data, intuitions and their expression; but it is in appearance only and merely for the exigencies of language and thought that they are distinct—it is not a division of reals. The intuition unexpressed is not something in its own right, and expressions are not existences which stand for or represent intuitions. It is the distinction between potentiality and actuality.

The concept of activity has itself, as Hegel would have said, opposition inherent in it. It is a union of being and non-being, an advance from affirmation, through negation to the concrete universal. In Croce's theory the activity of mind in its first moment is the expression of intuition in images; it is not, as the naturalist hypothesis requires, the discernment of external reality and the progressive apprehension of its nature. Mind is self-contained and self-subsistent from and in the first moment of its expression.

This may seem difficult when stated in the abstract technical language of philosophical theory, but when we turn it to the interpretation of concrete living experience it is illuminating. For we find that we have described the essential character of art and the typical behaviour of the artist. The artist is a creator, and he creates images which express his intuitions. Art is lyrical. It is the bursting forth in expression of the intuition in the artist's soul. Also we see what beauty is; it is expression. We see why it is objective and how its objectivity yet rests on subjective feeling. Delight in beauty is the pleasure of the satisfaction we experience in successful expression. We see further how beauty contains its opposite within its own concept. Ugliness is the displeasure which marks failure to express.

This in brief is the meaning of Croce's theory that beauty is expression. It leads to a theory of art. Art is language; and language being the primitive need of the individual, art is the universal linguistic. Its humble origin is hidden from us by the glamour which surrounds the masterpieces of fine art. These seem unique and exalted, the products of mighty genius, enshrining in fixed form for ever the clear vision and

high ideals of exceptional minds. The great artist, we say, has not only conceived a noble idea, but has known how to clothe it in beautiful, sensuous form and make it appeal to and inspire other minds. But this view of art, Croce points out to us, wholly overlooks the activity which is called for in the appreciation of a masterpiece. Before I can share or enter into the artist's vision by means of his work of art, I must find in that work the expression of my own intuition. Without this mental activity in myself a work of art is nothing to me. It is, then, a universal mental activity which makes art a language. What is essential therefore in art is not what is rare and precious in its noblest examples, but what is elementary and universal in mental activity, the expression of intuition, the production of the image.

Let us now consider Croce's theory of the concept. The concept depends upon images; images are particular and private; images do not of themselves give the sense of reality. The perception of reality and unreality supposes judgment brought to bear upon images, and judgment depends upon concepts. Images give us a complete world, but not a world in which actions are performed. Before mind can take the form of action there must be concepts, for concepts give objectivity to the images. The concept therefore is the second moment, the second degree which completes the theoretical activity. The pure concept is not a general term or class name, nor is it derived from images by a mental process or abstraction: it is concrete-universal. It is difficult to express this important doctrine in a few brief sentences; my best way will be to illustrate it.

When I expect another person to assent to a pro-

position which to me is true, I have only my particular experience as a particular individual to appeal to, but the whole ground of my reliance on my experience rests on the fact that I conceive my empirical consciousness as a universal consciousness. Unless I conceive this universal consciousness as immanent in my empirical consciousness and in that of other empirical individuals, I have no basis of appeal. Now I do not conceive it as something shared between us, nor as a general term obtained by classification or by abstraction from particulars; I conceive it as wholly present, and alike present, in each individual and not bounded by any individual nor by all individuals. This is the concrete-universal. The pure concept is always concrete-universal, and the concepts which we form by abstraction and use as class names for groups of particular individuals are pseudo-concepts. Thus such terms as horse, cat, red, triangle, house, and the like, are group names or class terms and are generally named concepts, but they are not pure concepts. They are abstract, not concrete; general, not universal. The concept is the pure intellectual expression of reality. For examples of pure concepts we must go to philosophy and the philosophers, just as for pure aesthetic intuition we must go to art and the artists. Philosophy in effect is the history of the concept, and every great philosopher is distinguished by his individual concept as the poet by his individual imagery. The Platonic Idea, the Leibnizian Monad, the Kantian a priori Synthesis, the Hegelian Dialectic, and in our own time the Bergsonian Élan vital, are all illustrations of the pure concept.

These two moments of the living process complete the theoretical activity and give us the two mental

sciences, aesthetic and logic. They are the two forms in which mind embodies its activity and there is no third. This negation of a third form is characteristic of Croce's doctrine. It marks his attitude toward psychology and also toward epistemology. He rejects the old division into feeling, cognition and conation in so far as the first of these is regarded as a kind of substratum out of which and from which knowledge and action arise. With the rejection of feeling, as a distinct moment conditioning knowing and acting, goes the whole basis and ground of the theory of psychological atomism and all other theories which construct knowledge out of an original stuff of experience, distinguished as a datum of sense. Sensations are in Croce's theory abstractions and, in their abstraction from the concrete life, unreal. This is perhaps the most important point in understanding Croce's theory in its relation to other philosophical theories. It rejects pure passivity as reality in any form whatever. Mind is all-inclusive reality and reality is activity. What does nothing is nothing. The inert is a limiting concept, not a thing-in-itself.

On this concept of the theoretical activity Croce bases his ethical theory. Images and concepts provide the stage for action. Possessing these, the mind can act because it knows. In the practical activity there are two moments and these are a twofold degree, for the second is conditioned by and depends upon the first. The first is economic, the second is ethical. The concept which applies to the first is utility, to the second goodness. The end of our action is presented to the mind in the first moment as our particular and individual needs, and its objects are presented as objects of individual desire; in the second

moment as universal needs and as objects of universal desire. The old ethical paradox, resting on the opposition of egoistic and altruistic action, disappears. Ethical conduct is neither more nor less rational conduct than economic conduct, and we have not to seek for a reconciliation in some utilitarian principle on the one hand or some transcendental principle on the other.

This in brief outline is Croce's scheme of the science of mind and the relation of its subsciences—aesthetics, logic, economics, and ethics—to one another. Those who would study it in detail must grasp the principle and appreciate the standpoint. It has no place within any scheme of common sense and scientific reality. It is necessary therefore to come to a decision on the fundamental problem before trying to solve particular problems. If the materialist hypothesis of a static reality, which by reason of movement imparted to it has given rise to life and mind, be adopted, then the phenomena of which I have been treating are ultimately nothing but exceedingly complex movements and the whole of philosophy as conceived by Croce is unmeaning. From the materialistic standpoint there is no approach to philosophy, unless it be in the fact that materialism breaks down by its own inherent contradiction. Philosophy starts with the simple recognition that reality is the active becoming within which we live and move and have our being. Mind is not the mind as the science of psychology studies it—that is, either as a phenomenon associated with certain physiological processes, or as an object in its own right and with its own nature, distinct from other objects with equal rights to substantial independence. Mind is, as Kant says in one of the most pregnant sections of the

Critique of Judgment, " all life, the life-principle itself." In studying it we are studying the reality we ourselves are; not a reality to which we are related as to something independent and indifferent, but a universal concrete activity apart from which we are nothing, and which in abstraction from us is itself nothing. Universal mind or life is immanent in us. Philosophy is therefore a methodology, a way of studying reality, not a science of a metaphysical reality either transcending or defining the realms of physical science and ordinary reality.

This is the starting-point and the conclusion of the philosophy of Benedetto Croce.

X

CROCE'S CRITICISM OF HEGEL

WHAT is living in the philosophy of Hegel in the view of Benedetto Croce is the doctrine of a logic of philosophy, a special and particular method, such as that expressed in the termination " logy " of such words as psychology, sociology, anthropology, and the like. This logic of philosophy was Hegel's discovery, a momentous event of inestimable value in the history of human thought and a permanent enrichment of human reason. It has become familiar, and we are able to discover the elements of it, or at least to discern a reaching towards it, in the works of his predecessors, notably in the three great Critiques of Kant, but its clear formulation by Hegel was nothing short of a revelation. It seemed, and it still seems, a bold paradox, but it has become a possession of philosophy. Reality is a concept, concrete and universal, holding together in indissoluble unity terms which, in abstraction from one another and from their unity in the concept, are contradictions, absolutely exclusive and even destructive of one another. The best-known and typical example is the first concrete concept in the chain of Hegel's categories, becoming. Becoming is the synthesis of two categories, being and nothing, each of which in the abstract is the

negation of the other. Their union in the concrete concept is not mutual destruction and pure negation but the attainment of a higher reality by the negation of negation. This is the principle of thought or reason in all its manifestations. Thinking is a movement through negation to a reconciliation of contradictions in a higher, that is, a concrete unity. It is the great distinction and the lasting glory of Hegel to have made this logic of philosophy explicit. In this sense only was it a discovery. Has not Heine said that already six thousand years before Hegel's birth the whole Hegelian philosophy was promulgated by the serpent in the Garden of Eden?

What is dead in the philosophy of Hegel in Croce's view is a certain application of this logic outside the sphere of philosophy. Not that in the ultimate sense any reality falls outside philosophy, but that a logic specially fitted to be the peculiar instrument of philosophy does not of necessity supersede the particular logic which each great branch of human knowledge requires. The notable cases in point are the application of the logic of philosophy to art, to history, and to nature. Hegel did not recognize that besides a logic of philosophy there is a logic of mathematics, a logic of natural science, a logic of aesthetic, a logic of history, etc., and that these logics are not modes of treating particular parts of reality, but modes of treating all reality, modes which arise and persist side by side with the philosophical, precisely because, within their own limits, they do not compete with philosophy.

Hegel had clearly shown that the abstract concept cannot stand alone, that it is driven by the very movement of thought itself to affirm the antithesis which contradicts it, and that only in the synthesis which

reconciles the contradiction of the elements does thought find the concreteness combined with universality which characterizes the real. But there are concepts which are not abstract. There are pure concepts, like beauty, truth and goodness, which are not oppositions but distinctive concrete realms of experience. They also stand in relation to one another. Hegel thought the same dialectic triad was at work here, and that the same method would be triumphantly vindicated. Hence a confusion in his doctrine, a failure to distinguish between the contradiction of the abstract elements of the concrete concept and the grades or degrees of reality which the concrete concepts all possess. A logical theory of classification must here give place to a logical theory of implication. An example may make it clear. Consider the relation of the two concepts art and philosophy. In Hegel's treatment these become a dialectical triad in which art is the thesis, religion the antithesis, and philosophy the synthesis. This is typical of Hegel's treatment of innumerable concrete concepts: they become triads, such as, thesis, the family; antithesis, civil society; synthesis, the state: also, thesis, life; antithesis, knowledge; synthesis, absolute idea. Yet it is clearly not in the same sense as that in which nothing is the negation of being that religion is the negation of art, and art and religion are not two contradictory abstractions which possess truth only in their synthesis philosophy. Yet art and philosophy do stand to one another in a relation of identity in difference, and if we hold that philosophy is the higher and more perfect unity, it is because we recognize that art implies philosophy and that philosophy includes art. Those familiar with Croce's philosophy will recognize that

on this distinction is founded one of his characteristic and fundamental doctrines.

When, however, Hegel went even further and applied the dialectic to the particular empirical objects of special science, and to the events and facts of history, fantastic and even ludicrous results followed. The Prussian monarchy and Prussian political institutions became the synthesis of a triad of which Oriental despotism was the thesis, Greek freedom the antithesis. Ruskin has told us in one of his autobiographical writings that when he was composing the *Seven Lamps of Architecture* he experienced considerable difficulty in keeping them within the sacred number, and Hegel was often driven to sorry shifts to cram awkward facts and events into his triads. The old world with its three continents conformed naturally to the arrangement. The first, Africa, he said, represents the dumb mind which does not attain to knowledge; the second, Asia, is the wild bacchantic rout, the region of formless, indeterminate generation, incapable of ruling itself; the third, Europe, represents consciousness, and constitutes the rational part of the earth; and the centre of Europe is Germany. But where, it may be asked, do America and Australia and other large islands find a place? He left them out because they seemed to him " physically immature." North America, he thought, might be regarded as an appendix of European civilization, but he refused to recognize any claim for consideration in the ancient civilizations of Mexico and Peru. They were bound to disappear, he said, at the approach of mind.

It was, however, in its application to natural science that the dialectic met its most direct challenge and seemed most signally to fail. Hegel himself was

undismayed, and met his opponents partly with invective, partly with sarcasm. Challenged by "the poor devil Krug" to deduce the moon, or, if not, then a rose, or a horse, or a dog, or at least the pen with which he, Krug, was writing at that moment, Hegel could only reply that science had far more urgent tasks on hand than the deduction of Mr. Krug's pen. Some apology has been offered for Hegel's special hostility to Newton in the fact that he was not alone in opposing Newton's theory, and that Goethe, who had a rival theory, was his personal friend. It was not, however, a particular theory but the whole positive method of science which was being called in question by the speculative method of philosophy. A jesting remark on the anecdote of the apple is amusing. Thrice, he said, had this fruit proved fatal to the human race, causing the fall of Adam, the destruction of Troy, and now, by tumbling on Newton's head, the ruin of natural philosophy. Croce will not allow the fact that Hegel wrote before the great expansion of experimental science in the nineteenth century to be pleaded in excuse. His fault was not that he failed to see the direction of human thought and to appreciate the inductive method which was leading to vast scientific discovery. It was that he fell into confusion in regard to two truths of equal and fundamental importance in philosophy, he confused the synthesis of contradictions with the degrees of reality and truth. Confident in his new discovery, the dialectic triad, he thought it applicable to the concrete and the particular as well as to the abstract and universal. This meant that wherever there is distinction there is also contradiction, only to be reconciled in a new and higher concept. But distinction and difference have also

another signification—that conveyed by the logical term implication. No partial reality stands alone, however relatively complete and self-subsistent it may appear—it holds within itself distinctions which point beyond itself not to its negation but to its inclusion within a larger system. Hence the task of philosophy is not to classify entities or facts, but to draw forth their implications. The theory of degrees of reality was implicit in Hegel, it permeates all his works, but it nowhere receives full and explicit recognition. According to Croce, Hegel himself positively obscured it by conceiving the movement of thought as necessarily triadic in form, and so it is that, notwithstanding his immortal discovery, his works are encumbered with so much that is no longer living but dead.

XI

EINSTEIN'S THEORY AND PHILOSOPHY

The principle on which Einstein's general theory of relativity is based is not new to philosophy. It is a complete revolution in physical science only because physicists have consistently and consciously ignored the problem of the relation of the mind to its objects. This has been treated as a speculative problem and turned over to philosophy, in order that science might be confined to the practical. Physics has therefore always assumed that the existence of the nature it studies is independent of the mind which observes it. Einstein asks us to abandon this idea. He asks us to suppose that there is no absolute reality which an observer may contemplate without taking into consideration the conditions of his contemplation. He asks us further to accept frankly the idea that every observer, human, infra-human or super-human, must in the nature of the case possess his own incommunicable standards whereby he co-ordinates his world. Finally he asks us to recognize that the idea of a universe common to all and private to none must depend upon, and can only be stated in terms of, subjective experience. This is his principle, and its introduction into and acceptance by physical science involves the immediate sacrifice of the simplicity which

we have become accustomed to associate with science, while it opens to us the vista of endlessly complex mathematical equations. No wonder it makes us pause and ask somewhat anxiously—Need we and must we?

Although the principle is not new to philosophy, it has been by no means generally accepted by philosophers as axiomatic. It might rather be said that it is the principle par excellence which philosophers have been divided about throughout the modern era of philosophy. The philosophy termed naturalism, for example, insists on the exact reverse of the principle. It declares knowing to be a pure act by which the mind becomes acquainted with, or discerns, the objective order of nature—a nature presented to it, not constructed by it, not even modified by it, and to which it stands in the simplest possible of all relations, that of compresence. The various theories included under the name of the new realism attempt to give consistency to this principle, but by their very opposition they concentrate attention on the problem how a reality confronting a knower or observer can be independent and yet known or observed. Idealist philosophers have consistently held that such independent reality is illusion, but they have found the illusion so obstinate in practical life that though they may feel they succeed in clearly and with unanswerable logic demonstrating its baselessness, they confess themselves powerless to dispel it, even in themselves in their most lucid moments. But philosophy is science of science, and therefore, whether philosophers have ranged themselves on the idealist or on the realist side in this unending dispute, philosophy has always been concerned with the study of reality as knowledge

and with knowledge from the side of the knower. For realists and idealists alike, therefore, philosophy is, in the very nature of its problem, heavily biased on the side of idealism, and it is the principle of idealism which the new general relativity theory is proposing as the one condition of success in science. Its acceptance means nothing less than the reabsorption of science in philosophy. It marks the convergence of two lines of intellectual development, completely fused in the ancient philosophy, which only began to diverge in the modern period, and which seemed until recently to be diverging ever more widely in opposite directions, contradictory in their tendency.

It is impossible, therefore, to understand the general principle of relativity unless we first comprehend the philosophical principle of which it is the practical recognition and the reaffirmation. I will state the philosophical principle briefly in the form which Leibniz gave it. It is at once precise and picturesque, and therefore easiest to understand when we overcome the strangeness with which the concept first strikes us. It has also the further advantage that Leibniz was Newton's contemporary and his rival in mathematical discovery, and it was Leibniz's philosophy which was ridiculed by Voltaire when he made himself the advocate and exponent of Newton's principles.

The simple substances of which the universe consists were named by Leibniz the monads. Monads are not physical atoms, occupying space. They do not form a system in which action is propagated from part to part and in which every movement is compensated by a counter-movement. The monads, said Leibniz, have no windows by means of which anything

can go in or pass out. The essence of the monad, that which distinguishes it from the physical atom, is activity. The monad is the active subject of experience and the universe is mirrored in each monad. The universe consists of the monads and of nothing else. The activity of the monad consists in perception alone, and therefore each monad is the whole universe from its own individual, inalienable point of view. You can no more separate the monad from its universe than you can remove the centre from a circle. This is Leibniz's doctrine stated briefly in philosophical language. The scientific general principle of relativity is the exact counterpart of this famous doctrine. According to it, every observer is indissolubly bound to his system of reference, and it follows, therefore, that in the limit there are as many systems of reference as there are observers, and there is nothing common, in the objective and absolute sense, to two observers. Each observer does, as indeed he must, co-ordinate the universe from his own individual standpoint, by his own individual axes of co-ordination. How, then, it will be asked, if this principle be accepted, is it possible to co-ordinate systems with one another, to have a physical science which shall be universally true? It is clear that if we are to have a science of nature to conform with a principle of individuality it can only be by finding equations which admit of uniform transformation when an observer passes from one system to another. This is the task which the new principle of relativity sets to the mathematician and physicist. It was the problem of the old philosophy, and the point at which, for the time at least, it broke down. Leibniz could offer no satisfactory solution, and, in accordance with the general theological setting

of the thought of his age, he resorted to an argument of the *Deus ex machina* order. He held the belief, to which in his age there was no rational alternative, that the universe had come into existence by the creative act of God, and he supposed, therefore, that, logically prior to creation, all possible universes must have been ideally present to God, who chose from among them and gave existence to that which to infinite wisdom was best. This universe, therefore, came into existence with its harmony pre-established, a harmony effectively part of the creative art.

It is little wonder that so fantastic a doctrine not only failed from the first to give intellectual satisfaction, but has since served to obscure the real insight which that great philosopher had into the nature of the metaphysical problem. In contrast to it the system of Newton stood out with a simplicity which appealed strongly to common sense. An absolute space and an even-flowing time seem manifest realities, whatever difficulty we may find in conceiving their limits or in conceiving them without limits. At least they provide a framework within which a perfectly ordered world, the planetary system, has been created, the universal and invariable laws of which are discoverable. But Newton had his theological difficulties. What was the relation of God to this absolute space and time? Were they part of the creation, and, if so, in what sense are they absolute? Is God unlimited by them? If so, then again, how are they absolute? If not, then how are we to conceive the Divine attributes of omnipresence and omniscience? Newton solved his problem in quite as arbitrary a way as Leibniz. Space he declared to be "the sensorium of God," and therefore in effect identified with the nature of God.

Any one may quite easily make the concept of the monad clear to himself if he will only follow out to the full logical consequences some ordinary and commonplace reflections which occur at times to every one. One of these is the impossibility of seeing the world from another individual's standpoint without actually being that individual. This is disguised from us in ordinary thought by what presents itself to us as an objective fact, language. It seems as though words must stand for things, and that the possibility of intercourse by language depends on an agreement between individuals to use words to signify things. Real intercourse is altogether different, as any one who will reflect may discover. Words evoke images or concepts. The image or concept my word awakens in the mind of another to whom I utter it cannot be identical with the image or concept in my mind who speak it. The response in each individual mind to a discursive word depends entirely on the individual's mental activity, and derives its whole content from his individual experience. In conversation nothing passes out of one mind leaving a void in order to pass into another mind enriching it by addition. Consider, again, another simple and ordinary fact of common experience. When you stand before a mirror you find it quite impossible to divest yourself of the impression that all that lies behind you in your three-dimensional world lies equally behind your image in the mirrored world. You dodge your head to right or left in order, as you imagine, to bring to view the objects which the image of your head is blocking out. You may know it is pure illusion, but can you dispel the illusion in practical action? I might instance many more illusions of ordinary life, but perhaps these are

enough to make clear the doctrine of the monad. It is that reality is activity; that this activity is essentially individualized; that each individual subject expresses itself by perceiving; and that perceptive systems are incommunicable. Monads are not parts which by external combination form a whole, they are each the whole, but viewed from an individual standpoint.

Let us now turn to the objective or scientific aspect of the problem in order to show the intellectual difficulties which have forced physics to adopt this standpoint. The world-view of absolute space and time which we are now asked to abandon is one which bristles with contradictions, one which it is impossible to present adequately to the mind in imagery, one which, moreover, involves a real dilemma and an insoluble antinomy. Yet, notwithstanding all its logical and metaphysical disadvantages, it is as natural and as unnoticed a background of our thought in our daily experience and in our scientific knowledge as the air we breathe is the unnoticed condition of our life. This world-view is that an absolute framework of space and time subtends the reality of the universe and is the principle of its unity and continuity, the fundamental basis of facts and events. To be asked to abandon this presupposition of nature brings a kind of giddiness over the mind. Yet many times in the history of our ideas has a like revolution taken place, and after each revolution the human mind has been found to adapt itself so completely to the new order that the old has not merely been discarded but has appeared fantastic.

In the ancient and mediaeval philosophy, for example, the world-view involved the notion of absolute direction. Above and below were not relative terms,

they had reference to a fixed earth. For the old Greeks, the gods lived on Olympus, or else somewhere *above* the sky. To the early Christians the Messiah had *ascended* into heaven, and they lived in the hope of seeing Him *descend*, appearing in the clouds. The mediaeval Christians imagined deeper and deeper circles in hell *below*, and wider and higher realms of bliss in heaven *above*. Then came the Copernican revolution and the human mind had to adapt itself to a new world-view, which in its first formulation must have seemed grossly absurd. It declared that direction in space was not absolute but relative, that the very same direction which one man experienced as up another actually experienced as down.

The problem of movement is very old, going back at least to the earliest Greek philosophers, but the modern discovery of the earth's diurnal and annual movements gave modern science and modern philosophy a new problem and a distinct orientation. The old Epicurean philosophy had tried to account for movement by the theory of atoms and the void. The theory sounds curious to us to-day, for it reverses the modern argument. We might say, translating it into modern concepts, that it propounded as the a priori condition of the possibility of movement, the non-existence of an ether. The void is not necessarily absolute space but it is absolute emptiness. How, the old atomists asked, is movement possible unless there be the void? Before anything can move there must be the unoccupied place into which to move. If the atom move, the void surrounding it must be as real as the atom. The void is not our modern notion of an extension which remains unaltered whether occupied or not, it is rather the notion of the discontinuity of the

atoms as a condition of their mobility. It was this notion which Descartes criticized. I can only indicate very briefly his argument. It forms one of the notable stages in the evolution of the modern science of nature. The essence of material substance consists, he held, in extension alone. Extension, therefore, is a positive quality and not a simple negation of quality, and it is not an abstraction. The void is, therefore, the concept of extensionless matter and so a self-contradictory idea. There is no void and nature is a plenum. Let the primitive state of the universe be what you will, said Descartes, give me matter and movement and I will create a world. The famous theory of the vortices, which held the intellectual world spellbound for half a century, was the outcome of this constructive theory. The vortex is simply movement in a plenum, declared inconceivable by the old philosophy. The significance of the vortex theory is not only its demonstration of the possibility of movement in a plenum, but its insistence that all movement is necessarily such. All movement, that is to say, is change of relative position, and there is no absolute position, just as it had now become clear there is no absolute direction. Descartes demonstrated his theory by many homely illustrations. When you push a boat from the shore, he said, you think the boat moves and the shore is at rest, it is just as true to say that the shore alone moves and the boat is at rest; either may be described as moving or at rest relatively to the other, and there is no movement which is not relative.

I think we may say that in everything essential we have in this theory of Descartes the new principle of relativity in its absolute purity. Why was it abandoned and what is now forcing us back to it?

What led to that complete revolution in the world-view which in the place of systems moving relatively to one another presented to us solar systems and stellar systems consisting of masses influencing one another, acting upon and reacting to one another, in an absolute rigid framework of space and an absolute irreversible order in flowing time? It was the problem of gravitation. Descartes had no satisfactory explanation of the property of material masses we term weight. It seemed to him to carry nothing of the necessity which in his view made extension the essence of matter. God had chosen to give matter weight, but no contradiction is involved in supposing matter created without weight, such, for instance, as would be involved in supposing that matter could be extensionless. Accepting the fact of weight the movement of the vortices explained the disposition of the elements. It was Newton's discovery of the law of gravitation which completely revolutionized the world-view.

Every one is familiar with the great concept of Newton that one and the same law applies to the fall of an apple and the revolution of a planet round its sun; that the whole universe is a system in which masses are drawn together and held apart by mutually compensating forces of attraction and repulsion. The famous law of the inverse square postulates as its condition a constant, invariable standard of reference. Newton's law requires the concepts of absolute space and time, and if we accept his further postulate of the inconceivability of action at a distance, it also requires an ether. Now, as I have said, these notions, though to ordinary common sense they seem obvious and by physical science are commended for their utility and simplicity as the basis of equations, have

never satisfied the philosophers. But it is the physicists, not the philosophers, who are discarding them, and for reasons which appeal with irresistible force to the scientific spirit. The advance of science has brought electronic velocities within the range of precise observation, and these have enabled us to bring experimental tests to bear on Newton's constants. They have not stood the test. Newton had only the telescope; we have the spectroscope. There is no alternative to science to-day but to abandon the world-view of absolute space and time, though mankind may long continue to use it as a hypothesis for purely practical purposes.

It is not necessary that we should be able to follow out Einstein's wonderful but very complicated calculations in order to grasp his principle. He takes a certain definite and finite velocity, the velocity of light *in vacuo*, as his constant for every observer in every system of reference; space and time are then the variables. There is no action of masses on one another, there are no forces of attraction and repulsion. There are only systems of reference in various movements of uniform acceleration relatively to one another. When the observer of a moving mass sees it altering its course or direction apparently under the influence of another moving mass, there is no exertion of force by the one or the other; there is an observational adaptation which involves a variation in the observer's space and time. We find it convenient to say that velocity changes in response to force; what is really happening is that our space and time co-ordinates are adapting themselves to a standpoint the maintenance of which requires that we should be uniformly at rest in continuously changing systems of reference. For

example, I may be travelling in an express train, or tossed about in the cabin of a ship, or walking on what I call terra firma; my Euclidean geometry, my spatial and temporal measurements, my gravitational constants are unaffected, notwithstanding that for every independent observer they undergo varying distortion. It is because every change in my system of reference is compensated by a variation in my space and time co-ordinates that observed velocities are kept constant notwithstanding the alterations in the movement of my system relatively to other systems.

Let me give one final illustration. On a frosty morning we may see the watery vapour in the air we breathe condense into a small cloud and then rapidly disappear, reabsorbed in the atmosphere. Now let us suppose that we are suddenly reduced in all our proportions till we are some billionths smaller as seen by an independent observer. The general principle of relativity tells us that the change we should have undergone could not possibly appear to us as a change in ourselves, for all our velocities would remain constant; the change therefore would be wholly in the space and time. The little globules of water would now be stars and planets at immense distances from one another, undergoing a slow age-long evolution and obeying the law of the inverse square.

The new principle of relativity is the triumph of an old principle of philosophy.

XII

THE METAPHYSICAL ASPECTS OF RELATIVITY

THERE is a possible misconception in the application of the term "metaphysical" to the new principle of relativity which it is advisable to clear up. In the great era of the triumphant advance of the positive sciences, which began about the end of the first third of the nineteenth century, metaphysics was decried as the main obstacle to scientific progress. Following the lead of Auguste Comte, the workers in the sciences held it up to scorn as obscurantism. The derision and reproach which were then poured on it have clung to it ever since. There are many to-day who acknowledge, indeed, that metaphysics must be assigned a place in the hierarchy of the sciences, but interpret the Aristotelian definition, "that which follows or comes after physics," as indicating a dark realm of the yet unknown, or even of the unknowable, which surrounds the clear zone of positive knowledge, into which we may peer, but will discern nothing. The objects of metaphysics—the soul, the cosmos, the deity—are in this view vain imaginings, not objects of which there can be knowledge in the scientific meaning—that is, objects amenable to the experimental method. Such a view simply ignores the

scientific tradition. Modern science is the result of the formulation and adoption of the experimental method, but the experimental method is not self-evident or inherently rational; it depends on a metaphysical concept, and its rationality can be established only by metaphysical principles. To contrast, then, the experimental method with the principles on which it depends, to describe one as the realm of science and the other as the realm of ignorance or unknowability, is from any philosophic point of view stultifying, and, in the literal sense, absurd.

What has made it possible to consider metaphysics as an unreal science, or as a realm of unreal fancy, is the peculiar position in regard to the natural sciences in which the purely mathematical sciences stand. Mathematics does not use the experimental method, and in the hierarchy of the sciences mathematics seems sufficient of itself for the foundation and support of the whole superstructure. But mathematics is only an abstract science of quantity; its concepts lack the one essential character which experimental science calls for—concreteness—and this metaphysics alone can supply.

The modern era of philosophy from Descartes onwards has been dominated by the insistence of the scientific problem—that is, the problem of the ultimate nature of the reality we study in physical science by the experimental method. This interest in the nature of scientific reality replaces the main interest of the philosophy of the mediaeval period, which was concerned with the origin and destiny of the human soul, and, more generally, with the relation of man to God. If modern philosophy may be said to join hands with the ancient philosophy of Greece, it is not in the

identity of its interest; for, though the Greeks were mathematicians, they had no conception of the experimental method as we practise it, and it is even doubtful if it could have been made to appeal to them on the ground of rationality.

The principle of relativity is the direct outcome of the application of the experimental method, and the full force of its appeal is based on our absolute confidence in the metaphysical concept of reality which is the ground and reason of that method. The experimental method has taken possession of the modern mind, and it assumes for us something like the unmodifiable character of an instinct. If experiment proves a certain velocity to be constant under conditions which require us to predict its variation; if experiment shows the movement of a source of light to be without the expected effect on the velocity of propagation—well, it is our concept of the nature of reality which must adapt itself to the experiment. The prediction is based on the concept that space and time provide an absolute system of reference; the null result of the experiment negatives that concept and henceforth space and time are " shadows "; they must vary, because under varying conditions velocity is constant.

Those who affirm that the principle of relativity is purely mathematical, and not metaphysical, and, therefore, resent the intrusion of metaphysics into the discussion of its equations, conceive the principle to be purely methodological, to be concerned only with abstract quantitative measurement, and merely to substitute a very complex and difficult set of equation-formulae for a discarded simpler one, in the interest of greater precision and accuracy alone. Those who

take this view seem to me to misapprehend the significance of the principle. It is to be understood only when taken in its historical connexion with the metaphysical constructions of the great philosophers.

Since Descartes, the speculations of philosophy have centred round the concepts of substance and cause, and the principle of relativity in its two phases, special relativity (the restricted theory) and general relativity, is essentially concerned with these two concepts. The first phase, in its negativity towards the ether hypothesis, is a reform of the notion of substance; and the second, in its rejection of influence and its substitution of equivalence for attraction in a new theory of gravitation, is a reform of the notion of cause.

Two opposing principles in regard to both these concepts—substance and cause—have been struggling to establish themselves throughout the modern period —one taking as its type the objective or passive aspect presented by the world to the mind of the observer, the other taking as its type the subjective activity of the mind itself in perceiving, imagining, understanding, willing, and acting. The first type we have in Descartes's concept of material substance as consisting in extension alone, and in his concept of cause as the mechanical action and interaction of a definite quantity of movement imparted to the extended substance—the concept of a mechanism which embraces the whole universe, organized and unorganized, exclusive only of the other substance, thought or thinking, present in human beings alone. Later we have the same type in the more familiar concepts of Newton—absolute time and absolute space. "Absolute time, in itself, and from its own nature, flows equally, without

relation to anything external." "Absolute space, in its own nature, without relation to anything external, remains always similar and unmovable." The other type of concept we have in Leibniz's monadology. Substance is not passive, but active; cause is not movement, but force. What does nothing is nothing. Time and space are *ordines rerum non res*. Things are centres of active force.

It is with these concepts of substance and cause that the principle of relativity is primarily and mainly concerned, and these concepts are metaphysical constructions. Experimental facts have called for the formulation of the principle, but those facts themselves have slight importance in the practical sphere; it is their theoretical consequences which are far-reaching and revolutionary. They are facts which prove to be decisive in regard to metaphysical problems. The experiments are concerned with such infinitesimals as 42 seconds in relation to a century, or a variability of $2\frac{3}{4}$ inches in the diameter of the earth. It is not the facts themselves, therefore, that are important, but their significance. According to the view which I have expressed in my books, *A Theory of Monads* and *The General Principle of Relativity in its Philosophical and Historical Aspect*, the principle of relativity definitely decides for us that our universe is monadic, and that our science does not derive its validity from a reality independent of the monads, but from a power inherent in the monads to co-ordinate ever-varying points of view. By monads I mean minds, but minds conceived as metaphysical reals.

The point of supreme and central importance in the principle of relativity in its bearing on metaphysics is its negative attitude to the concept of

absolute space and absolute time continua. The principle accepts the null result of the experiments as decisive in regard to the non-reality in the physical sense of such continua, and it refuses to recognize any necessity to construct *ad hoc* a hypothetical absolute space-time system. On the other hand, it claims to provide a formula which expresses the identity of an event for two observers in different systems who pronounce it to be one and the same, without the necessity of affirming an absolute order independent of their systems of reference.

Why does this seem paradoxical and in contradiction to our ordinary experience? Because our experience consists in the observation of events which we do not cause; which we refer to in our intercourse with our fellows as common to them and to us; and to which throughout life we, automatically or consciously, react. We argue by what appears to us the most perfectly natural reasoning that the identity of an event for two different observers implies an absolute order by reference to which alone differences of observation can be reconciled. This absolute order, we think, can be nothing else but the determination of every event in regard to every other event in an absolute co-existence in space and in an absolute succession in time. We conceive, therefore, an absolute space-time order, and suppose our private space-time systems are related to it. Such is the course of reasoning which appears natural, and such is the logical necessity from which it appears impossible to escape. Metaphysicians have long disputed it, but their arguments have been generally set aside as logomachies. Experiment has now falsified it.

What sort of thing, then, is the relativist universe? Substance and cause—that is, the principle of unity and the principle of uniformity—are definitely transferred from the object to the subject of experience. I do not mean that object and subject are dissociated; I mean that substance and cause are declared to be functions of the essential activity, and not of the passivity of experience. Thus, the universe depends on the subject of experience, not, indeed, in the old and often derided sense which in the philosopher is caricatured as evolving an eternal world out of his own inner consciousness, as the spider spins its web out of its entrails, but in the sense that the universe is the co-ordination which the observer effects. The universe has four dimensions—the three dimensions of space, and the one dimension of time. The principle of co-ordination is that every observer uses his own axes of dimension, taking his system of reference as fixed in relation to all systems which for him are moving, and he is able to do so because his four axes are variable, and every change in his own system of reference, relatively to other systems, is compensated by a variation in his axes of co-ordination which preserves the ratio constant.

The universe, then, which the principle of relativity affirms is a universe in which there is no absolute space-time order; in which every event is exhausted in the contradictory descriptions of observers in different systems of reference; in which systems of reference are ultimate without being absolute, and relative without being externally conditioned; in which every system is self-sufficing and contains its own norm, a norm which remains constant by changing as the system changes. In such a

universe, are mathematics and physical science possible? The relativist claims that they are capable of infinitely greater precision and consistency than they could ever attain while obstructed by the old concept.

XIII

"AND GALLIO CARED FOR NONE OF THESE THINGS"

It is not a little curious to contrast the marked indifference of philosophers to the new scientific discovery with the profound consciousness the mathematicians express of its fundamental philosophical significance. No doubt in the seventeenth century, when the new discovery of Copernicus was winning acceptance among men of science, the orthodox Scholastic philosophers took up the same Gallio attitude of indifference towards it which so many contemporary philosophers are now taking to Einstein's theory, and yet the whole movement of modern philosophy, which arose with Descartes, clearly starts from the Copernican revolution, is based upon it, and not only historically but intrinsically is unintelligible save in the light of it. Professor Weyl has expressed the opinion that the discovery of Einstein is no whit inferior to the discovery of Copernicus in the tremendous consequences which follow from it and in its complete reversal of our ordinary conception of the nature of the physical universe. This is no exaggeration. To me it seems certain that even the most brilliant scientific achievements of the nineteenth century will in the future be classified as pre-Einsteinian.

The analogy between the two theories is in itself very remarkable. It may be illustrated in regard to quite ordinary experience. For example, every one knows the danger of alighting from a train in motion and also that the danger is proportionate to the velocity of the train. Most of us think that the explanation is simple, and so obvious as to seem self-evident. It is due, we suppose, to our inability to keep our balance. It seems both impossible and unnecessary to imagine an alternative. We suppose that the moving system of the train has induced some subtle change in our mentality, forming a habit which we cannot break when we pass suddenly from the train to the platform. Yet there is an alternative explanation. It may be due to a cause which is purely geometrical and to no change whatever in ourselves. The space into which we step may be so altered in its character by the movement of the train relatively to it, that the direction of anything entering it is automatically changed. Again, to take another example, we are all familiar with the popular experiment in physical laboratories to show the behaviour of iron filings when a magnet is brought into their neighbourhood. We say that the filings are magnetized and suppose that the definite and ordered arrangement they assume is due to a change they have undergone under the influence of the magnet. But there is an alternative explanation. It may be due to the geometry of the magnetic field. It may be that the filings undergo no change in their nature whatever and that their apparent behaviour may be the simple and mechanical effect of the strains and tensions of space in the magnetic field. According to the generalized theory, this is the scientific explanation. The reason for choosing these alter-

natives in each of these cases is that the interpretation of the phenomena they offer is at once simpler and intelligible. Precisely in the same way when Copernicus announced the heliocentric alternative as an interpretation of celestial phenomena, it forced itself on the acceptance of the scientific world by its simplicity and intelligibility.

I am quite ready to admit that philosophy, in its technical meaning, is not necessarily concerned with the reasons which men of science may have for deciding between alternatives such as these. But suppose a philosopher or a philosophy to be committed to one interpretation of the facts, presupposing it as the starting-point of theory and therefore excluding the alternative, there is no possibility of indifference then. It is not a matter for the mathematicians to settle, for the philosophy stands or falls with the decision. This seems to me to be precisely the case in which the materialists and natural realists stand. They suppose they can be indifferent whereas their whole philosophical principle is at stake.

To return for a moment to our two illustrations, the alternative interpretations bring to light two principles which present to one another a complete contrast. The common sense interpretation invokes as fact, on the basis of empirical intuition, a principle which on the objective side is both unintelligible and irrational—the principle of action at a distance; and on the subjective side supposes occult changes in the nature of the agent which induce an illusion in the action, in itself quite inexplicable. The other principle interprets the behaviour by simply setting itself to discover the geometry of the field in which the apparent action occurs. From the standpoint of

pure methodology only the second principle can claim to be scientific.

So far, however, I have spoken of these two alternatives as though the choice were freely open to us to accept or reject either, and as though, in choosing, the only decisive factors were simplicity and convenience. But science requires more than this, it wants assurance of fact. It must be satisfied before everything that the basis of reality on which it builds is absolute. It cannot compromise. Galileo, after his recantation, when the famous words *eppur si muove* escaped his lips, was instinctively expressing the inmost nature of the scientific spirit. Einstein is his true follower. He sees with the clearness of intuition that the one essential condition of science is the absoluteness of its foundation, and his marvellous genius has directed him unerringly to the only ground on which that absoluteness can be established —sense-experience.

I will now explain what I take to be the special and important work of Einstein so far as it affects philosophy. It seems to me then that just as Descartes, probing the significance of the Copernican theory and forced thereby to his method of universal doubt, discovered the fundamental truth that the " I think " affirms an existence secure from doubt, so Einstein, searching for the significance of the negative result of the Michelson-Morley experiment, and convinced of the impossibility and futility of presupposing the existence of the absolute which science requires, in a hypothetical substratum, concluded that it must lie in knowledge itself. To this conclusion he was no doubt directed by the influence on him of the work of Ernst Mach. He finds the absolute precisely

where Descartes found it, in the " I think " of active living experience, but whereas Descartes failed to discover any way of passing from the " I think " to the reality of the physical world, and at last fell back on the expedient of invoking the principle of the veracity of God, Einstein has found a way which at no point whatever introduces either hypothetical factor or transcendent cause. It is this, apart from any special value in his actual mathematical work, which constitutes the claim of his theory to be philosophy. His scheme of a universal geometry is in its essentials remarkably similar to Descartes's universal mechanism. It differs from it in the important particular that whereas Descartes conceived the universe as three-dimensional, and its space as Euclidean, and independent of the time-factor, Einstein conceives it as four-dimensional with time as one of the axes of co-ordination, but the superiority of Einstein's scheme from the standpoint of philosophy is that its construction and constitution are inherent in and never transcend the conditions of actual individual experience.

The principle of relativity is not the rejection of an absolute and the affirmation of universal relativity. That would be equivalent to the affirmation of universal scepticism. What the principle rejects is an absolute which is independent of experience, and therefore outside knowledge, an absolute which has to be postulated as the condition of knowledge. The absolute of the relativists is in experience and therefore wears a different aspect. The principle of relativity claims that it is workable and that it provides a position from which advance can be made and nature interpreted. It yields in the first place a mathematics, and this in its turn can offer a material to physics. It completely

reverses therefore the old order according to which mathematics was an abstraction from physics. In the new principle physics depends on mathematics and not vice versa, and mathematics becomes an empirical instead of a transcendental science.

It was a scientific discovery and a philosophical necessity arising from that discovery which led Newton to affirm absolute space and time. It is because the theory was based upon and necessitated by a definite scientific fact that Newton never regarded it as hypothesis. The discovery was that there is a velocity of light. The story of his reflection on the fall of the apple belongs to the year 1665, the *Principia* was published in 1686. It was midway between these two events, in 1675, that Roemer, the Danish astronomer, observed the discrepancies in the times of Jupiter's moons, which could only be satisfactorily explained by the theory that there is a definite velocity of the propagation of light. It was this discovery, previously neither suspected nor even imagined, which necessitated the postulate of absolute space and time. It is clear that without such a postulate it was no longer possible to fix a time-table for astronomical events. The planetary movements do not occur when they are observed, their precise date must be calculated. This is why, in spite of all philosophical difficulties and theological objections, Newton's postulate won immediate and universal recognition in science. For two centuries nothing occurred to throw doubt on it. But now a scientific discovery and a philosophical necessity arising from that discovery have led Einstein to reject this postulate and compelled him to look elsewhere than in space or time, or generally in the external world considered as independent existence, for an

absolute on which to base the concept of physical reality. Let us then endeavour to follow the argument in so far as a principle of philosophy is involved.

The velocity of light must, as Newton saw, be included in all the equations which are concerned with the measurement of celestial phenomena. Scientific discovery has now established as fact that this velocity, though finite, is constant for all observers, whatever the relative velocity of the systems to which they are attached. The postulated absolute of Newton's *Principia* is therefore condemned as futile. The reason is obvious. There can be no experience of an independent system of reference which would provide us with the means of compounding the velocity of light with velocities of translation, because light signals are our ultimate resource. Clearly all astronomical observations, that is, all knowledge of the universe beyond the range of our muscular and other bodily activities, depend on visual experience and its interpretation. Velocity is a ratio between two factors, space and time. If then a velocity is constant under conditions which imply variation, the component factors must vary. It follows therefore that the absolute is not the object of knowledge taken in abstraction, that is, it is not the external world, it is the observer or subject of knowledge and a function of his activity. How then is subjectivism avoided and physical science possible? This is the point of supreme philosophical interest.

The absolute is the " I think " which in affirming its activity posits existence. The " I think " does not presuppose existence; it is not generated but generator. What does it possess wherewith to construct, order, regulate, and constitute the world which

it posits by the very nature of its activity? Descartes replied, extension and movement; these, he said, are clear and distinct ideas in our mind and their existence as an external world is guaranteed by the veracity of God. Einstein replies, sense-experience; this alone is the immediate object of consciousness, and from it therefore the physical reality of science is constituted. What then is the mode or form of the activity of the " I think " which gives this physical reality? Einstein replies, geometrizing. Sense-experience presents itself to consciousness in the form of event, and the fundamental activity of consciousness consists in co-ordinating events. In this co-ordinating we use four axes, three for space and one for time, and thereby we are able to fix the point-instant of every event in relation to every other. How does such a process, being essentially individual, yield a common objective universe, a universe of which there can be mathematical and physical science in the absolute meaning? It is in the answer to this question that the whole significance for philosophy of Einstein's scientific revolution seems to me to lie.

The starting-point of the new theory is the rejection outright, not on purely logical or epistemological grounds, but as experimentally disproved, of the belief in a substratum, material or spiritual, mathematical (space-time) or physical (matter or ether), hypothetically postulated as the cause of the phenomena of nature. The rejection of this hypothesis in any form leaves us with only one alternative. If the absolute is not what we observe in nature, and nature does not supply us with a standard of reference, then the phenomena of nature must be relative to a standard which is furnished by the observer himself.

That we do in fact furnish ourselves with a standard in measuring phenomena is entirely in accord with experience. Our " I think " is, as matter of fact, attached to a system of reference, primarily to our body as the mobile instrument of activity, secondarily to a particular physical environment which provides and also limits the range of our activity. It is from these systems of reference, and in relation to them, that we derive our axes of co-ordination, and determine our units of measurement. We find therefore in ourselves, in the activity of consciousness itself, in the nature of the " I think " and the necessity it imposes upon us of organizing our activity, both the standard of magnitude and the norm of direction. When we observe systems in movement, systems of reference to which we are not attached and which are moving uniformly or non-uniformly in relation to our own, we co-ordinate these, but necessarily from the standpoint of our own system at rest. If this be granted let us see precisely what follows from it. The principle declares, we repeat, that an observer attached to a system of reference, co-ordinates every point-instant of an event, and the world-line, that is, the track of such an event in the four-dimensional universe of his sense-experience, not from the standpoint of an independent absolute system, but from the fixity or stability of his own system regarded as at rest. It follows then that if the observer's system itself changes relatively to other systems such change will appear as change in the other systems. Also if the observer pass suddenly from one system of reference to another, which may even reverse all the conditions of the first, he will carry with him the standard and norm, and these will automatically adjust

themselves, so that every system into which he passes will by the very condition of his attachment to it be a system at rest. All this the principle itself explicitly lays down. We have then only to extend it by the recognition that to every observer attached to a system moving in relation to ours, his system is for him at rest and ours to him is moving, and his axes of co-ordination must then vary in relation to ours according to the velocity and uniformity of his movement relatively to ours. There is no limit to this principle theoretically. There is a geometry therefore of every point-instant in the universe because we can conceive it as a system of reference from which some observer is co-ordinating events. No point and no instant can have relations to other points and other instants which are identical for observers in different systems. Is such an infinite plurality and absolute subjectivity consistent with the community of basis which science demands for its reality?

A very simple illustration from ordinary experience may serve to indicate the nature of the reply to this question. What do we mean when we speak of pain? We all know what it is, and we distinguish it into kinds according to the definite conditions under which it occurs, and not according to the individuality of the persons who experience it. We conceive pain as identical though the subjects who experience it are diverse. In what then does this identity consist? Clearly not in sameness for there is no sameness. What one individual experiences cannot be experienced by another. Identity consists simply in the fact that we can establish point-to-point correspondences between individuals. No one imagines that to establish identity there must be assumed to

exist an independent pain-in-itself which no one suffers but which is the transcendental cause when any one suffers. Einstein holds that precisely the same principle applies to the co-ordination of events and to scientific reality in general. There is no uncoordinated event, no absolute event in an independent system, and there is no sameness of events occurring to different observers. In order that there shall be identical events for observers in different systems, all that is necessary is that the axes of co-ordination of any system shall correspond with those of another and therefore be transformable one into another. Observers in different systems will then describe the observed event in the same terms, the facts will be common to all, and the laws of nature will be universal.

The whole conception of the universe is now seen to be the exact reverse of that on which materialists and natural realists have insisted. Instead of a limited knowledge of an infinite universe, the new principle gives us a universe the knowledge of which is unbounded but the reality of which is finite. The two essential conditions on which the materialistic conception depended, simultaneity and direction, conditions of the possibility of dating every event and fixing every point, have been falsified by experiment. The new conception is not the arbitrary speculation of a fertile imagination, it is imposed on thought by an inherent necessity of its nature. The physical universe is the systematization of infinite space-time systems, on a principle which only asks us never to loosen our hold on experience in order to go beneath or beyond it, but always and only to seek to interpret it.

Einstein's conclusion that the physical universe is

finite but unbounded follows necessarily from the principle that the absolute is the " I think " of personal experience and from the fact that the nature of its activity is geometrizing. The universe is finite because the straight line of every observer is curved for other observers, and therefore every straight line is a geodesic which at infinity must return on itself; and the universe is unbounded because the approach to the limit is infinite.

I will carry this argument no further, not because I am likely to have said enough to silence criticism, but because to interpret the full significance of the conception of a finite yet unbounded universe would involve the history of the mathematical researches of Gauss and Riemann, and the physical researches of Faraday, Clerk Maxwell and their successors, and I am only concerned with the bearing of these researches on philosophical theory. My argument is addressed to my fellow-workers in philosophy. I am amazed at what seems to me their short-sightedness in imagining that philosophy can be indifferent to this stupendous revolution in science.

XIV

THE VOYAGE IN A CANNON-BALL

Suppose two persons A and B conversing with one another by telephone over a distance of, say, five hundred miles, for a duration of, say, three minutes. The three minutes is identical as time lived in each experience, its beginning and its ending are at instants which correspond so that the interval is precisely the same in each duration. But the three minutes lived by A is not simultaneous in the absolute mathematical meaning with the three minutes lived by B because the transmission over five hundred miles of connecting wire has taken time. This interval is inappreciable by A or by B and also it is irrecoverable by either. Is it possible then to calculate it and so to adjust the difference between A and B that absolute simultaneity can be established? Clearly not. It can be determined relatively to some other frame of reference, such as one which would take sound or light as instantaneous, but as each of these has an interval of transmission we only remove the difficulty one stage. Further, though the interval in question is inappreciable to A and B, this inappreciability is only relative to their frame of reference. For an observer attached to a frame of reference of microbial dimensions, still more for one attached to a frame of electronic dimensions, the in-

appreciable discrepancy in the simultaneity of the time lived by A and B would be a period in which a life or generations of lives would pass. We may conclude therefore: first, that in all communication which involves transmission between observers in the same frame of reference, there is a time interval which neither communicant can co-ordinate in his time lived so as to establish simultaneity; and, second, the magnitude of this time interval as time lived is not absolute but relative to the frame of reference.

Let us now suppose that I am observing an individual microbe by means of the high magnification of a microscope, and that this microbe has full range of its activity and is with its complete environment within my observation, and that I am able to see under these conditions the microbe living its own life in the rhythm of its own duration. Are the events which I am then observing simultaneous with the events which are happening in my life in observing? The interval of transmission in the light propagation from the object to my retina may be ignored—the difficulty is of a different and more serious kind. In distorting by magnification the spatial dimensions of the microbe's frame of reference I am quite clearly also distorting the time dimension. The microbe's time as observed by me is clearly dilated in proportion as its space is expanded, just as in the analogous case of the cinematograph if I retard or advance the time dimension I thereby expand or contract correspondingly the spatial dimensions. The order of events in the microbe's life is not disturbed by my observation under the conditions of magnification, but the relativity of the magnitudes to the frames of reference, that of the observer and that of the observed, makes point to

point correspondence different from point-to-point simultaneity. We may conclude therefore that between frames of reference whose magnitudes are disproportionate, though there may be point-to-point correspondence in their times measured, there is no point-to-point simultaneity, theoretical or practical, in their times lived.

Let us now proceed to consider the paradox of the voyage in the cannon-ball, familiar to every one who is acquainted with the expositions of the principle of relativity. Suppose a traveller to leave the earth on a projectile moving at a velocity lower by about the twenty-thousandth than the velocity of light; suppose that when he has lived one year he meets a star and is then returned to earth at the same velocity, he will find on leaving his projectile that the earth in his two years' absence has aged two hundred years.

This paradox was originally used to illustrate a consequence of Riemann's metageometry. It was quoted by Langevin in his address at the Philosophical Congress at Bologna, 1911. It is fully analysed and worked out by the formula for the Lorentz contraction in Becquerel's *Le Principe de relativité* (Paris, Gauthier-Villars, 1922). Bergson in his *Durée et simultanéité* (2nd edition, p. 246) has quoted an illustration of the paradox with different relative times for the two clocks, which makes the simplicity of the argument plainer. In this illustration we are asked to suppose two persons, Peter and Paul, together at a point on the surface of the earth. They set their synchronous clocks at the moment when Paul enters the cannon-ball and is transported into space with an immediately attained constant velocity of 259,807 kilometres a

second. This velocity is chosen in order that the Lorentz contraction $\sqrt{1-\frac{v^2}{c^2}}$ shall be equal to $\frac{1}{2}$. Paul's journey outwards is two hours recorded by his clock: he returns at the same velocity and rejoins Peter. He declares he has been four hours away, the time recorded by his clock. Peter's clock, however, records an absence of eight hours, and Peter is able to declare that he has effectively lived that period of time. Paul, on the other hand, is equally able to affirm that he has effectively lived the four hours which his voyage has required and no more.

The story is told of the English philosopher, Thomas Hobbes, that his first interest in mathematics was aroused in middle life when he chanced to open a volume of Euclid's *Elements*, a work hitherto unknown to him, at the 47th Proposition of Book I. As soon as he had read it he exclaimed, " My God, this is impossible! " So the reader of this paradox, if he is unacquainted with the mathematics of relativity, may be inclined to dismiss it summarily with the remark that it is impossible, and that the explanation can only be the simple one that one of the clocks has gone wrong. He may be quite right in this judgment, but it will not enable him to escape the paradox, which will then take the form that there is no means of deciding which clock is wrong, for each can produce the identical proof that his clock and his only is right. The paradox arises in the fact that magnitudes are relative, not absolute; that time lived is constant and independent of the frame of reference; and that time measured is variable and relative to the frame of reference. The paradox is that two measured times may differ in dimension, the one being a fraction of

the other, and they may yet as times lived be simultaneous.

Let us first make sure that the paradox is a true antinomy of reason and neither a sophistry nor an illusion of sense.

So far as the figures are concerned the calculation is a simple sum in arithmetic. In the case of the two years' voyage in the cannon-ball and two hundred years' absence from the earth, however, no account is taken of the earth's rotation, though this is the clock which gives us our time unit. The discrepancy only appears between the periods measured by annual revolutions. The traveller is absent for a period which in his experience of time lived is two annual revolutions of the earth in its orbit, but this period in the experience of time lived by those who have not left the earth is two hundred revolutions. Now although the diurnal rotation of the earth does not affect the conclusion it is very important for the comprehension of the argument; for the unit of time which is one of the terms in computing the velocity is a definite fraction of the period of the earth's diurnal rotation on its axis, measured by the space through which a point on the earth's equator is carried. Let us introduce this factor, and the argument which gives the paradox as its conclusion is obvious.

Let us suppose that the traveller in his projection into space continues to participate in the earth's diurnal rotation. This will mean that the earth will continue to be his clock. His direction in space will always be a line drawn from the centre of the earth through the point on the surface of the earth which he has left. His journey will be along the line of a rotating axis and, however distant from the earth's

surface, he will perform the complete diurnal revolution which a point on the earth's surface performs. This may seem complicated, but it is really simple, because the alternative is to suppose that he becomes for an inhabitant of the earth a fixed star and then he makes diurnally the counter rotation of the firmament which is observed by the earth dweller. This being our hypothesis, it is easy to calculate the wider space through which he will be carried the further he travels outwards; yet however wide this spatial extension, the unit or second of time will be the same fraction of the diurnal rotation which it is on the earth's surface. But though the fraction will be always identical its spatial magnitude will vary with the distance from the surface of the earth. We can now see at once how the paradox arises. It is open to us to conceive either of two alternatives. We may suppose that the projectile and the passenger it contains adapt all their dimensions to the changed frame of reference, that is, grow proportionately more massive and apprehend relatively larger time units—their measuring-rod lengthens, their pendulum swings wider. This, according to the principle of relativity, is what must and what in fact does happen, and therefore for the theory of relativity there is no paradox. Or, we may equally well conceive that the dimensions undergo no change whatever with the changing frame of reference, that the old rhythm of duration is carried into the new system. In this case it is clear the disproportion in the magnitudes will amount to a complete breach of continuity and it will be impossible to establish point-to-point simultaneity in the times lived. The traveller will become in his new system as a microbe was to him in his old system, he will live

out the rhythm of his duration in what in the old system may be an infinitesimal portion of it.

Both alternatives are conceivable. In neither case is there any question of illusion or any sophistry in the argument. If we adopt the second alternative and conceive a conscious individual to pass to a new system of reference without automatically adjusting his dimensions to that new system, if we suppose him to be a dwarf in a Brobdingnagian country or a giant in Lilliput, then we have the paradox that the whole is exactly equal to a part of itself.

It is well to look at a paradox in every possible aspect. Precisely the same difficulty of correlating time and space, conceived as invariable, occurs if we take the reverse order and suppose our traveller, instead of journeying outwards, to journey within the earth's sphere and towards its centre. Imagine an earth translucent and penetrable; it is clear that as we approached the centre or occupied concentric spheres nearer to the centre, either our dimensions would have to contract or we would become increasingly and disproportionately gigantic. The actual centre is a critical limit at which mass is nil, just as the velocity of light is a critical limit at which mass is infinite.

I may be reminded, however, that all these paradoxical results are realizable on the surface of the earth without the necessity of taking a voyage into outer space or into the interior of the sphere. The inhabitants of the earth are not congregated on the equator, they move freely in either direction towards the poles. In doing so they must undergo all the variations in the velocity of rotation which we have supposed between the surface and the centre or between

the centre and outer space, even to the critical point at which rotatory movement is null. Yet they suffer no inconvenience. We do not, or if we do we are wholly unconscious of it, alter our dimensions as we move towards or away from one of the poles. The reason is that these variations in the system of reference are wholly compensated by the convention which makes us regard the day as varying in length with the latitude. The conventions of time-measurement would probably have been entirely different had the founders of civilization and the primitive astronomers inhabited the Arctic Circle instead of the plains of Mesopotamia, the Nile Valley and the shores of the Mediterranean. For them, sunrise and sunset were the natural divisions of time, but as these varied, they had to take the annual revolution as well as the diurnal rotation into account. When Moses instituted the Sabbath, when Mahomet imposed on his followers the obligation to fast from sunrise to sunset during the month of Ramadan, it could not have been possible for them to conceive that there were habitable regions of the earth where the sun would not rise and set as it rose and set daily for them but remain for many of their days continuously above or below the horizon. It is simply due to the fact that the earth's revolution is not on the plane of its equator that the measurement of time has had to take the double movement into account, or rather that the actual period of the diurnal rotation cannot be determined by a single natural phenomenon such as sunrise. We have in this astronomical time-measurement an instance of an infinite variability of mathematical time, unified by the constancy of psychological time, or time lived.

There is then a paradox in the rejection by the

principle of relativity of a time which is one and universal. It concerns time lived. If any two events which for a given system of reference are simultaneous are for other systems before and after, and if it is possible for an observer to pass from one system of reference to another, then it is possible to experience the same event as having variable duration. For the time which we measure varies with the movement of the system for which we measure it; the clock by which we measure time varies with the spatial magnitudes of the system; and yet the time lived is constant. There is no absolute size; yet magnitudes which in different systems are greater or less, for life in the systems are constant.

The scientific principle therefore raises directly a philosophical problem. How are we to conceive a universe in which magnitudes are infinitely variable and infinitely ambiguous? Magnitudes are not abstractly spatial, they are spatio-temporal. We are therefore called upon to think physical reality in an entirely new way. The principle of relativity in rejecting absolute space and time, and so making the exact determination of magnitudes impossible, seems to take away the essential character of objectivity from physical reality and with it the whole basis of independence of the universe. The objective universe of modern science is not independent of, but interdependent on, the subject of experience. There is no way of presenting an object of knowledge in complete detachment from the conditions of knowing. In modern philosophy we have the exact counterpart of this scientific principle in Leibniz's theory of the monads. It is when the two principles are compared that they become interpretative of one another,

Together they point to a new concept of the nature of the physical reality of the universe. In science the old notions of space, time and material as a primordial structural basis are replaced by the new notion of a co-ordination of observations by the discovery of constant mathematical relations between infinitely variable terms, which when they are true for one system are true for all systems. In philosophy the notion of a universe contemplated by minds able to discern its external relations is replaced by the concept of active wholly self-contained subjects distinguished by the internal rhythm of their duration, centres of infinite different worlds, which yet express a common universe by the functional correspondence of their internal relations.

The parallel between the two principles is sufficiently striking. The essential point in the principle of relativity is that the observer attached to the system of reference can only co-ordinate the universe from the standpoint of his system at rest. He has no choice in the matter. In the last resort his co-ordination is conditioned by that postulate. Yet he must allow to other observers in other systems that their co-ordination depends on the same postulate. It is this recognition which yields the common universe. When we apply the principle to actual experience, to time lived, it means that no observer of physical events passes out of his own space-time continuum or changes the mathematical ratios of his dimensions when he passes into a new system of reference; the factors vary to maintain the ratio constant; the terms change their dimensions infinitely to maintain the observer in an unchangeable equilibrium which is absolute. Thus, I am always at the centre of the universe, co-ordinating

it from an unchangeable position. I may place an observer at any point-instant of the continuum and imagine the universe as I should co-ordinate it from that standpoint, but he, if he is actual, is co-ordinating it from my standpoint of rest but rest in his system. Truth therefore for each of us is not pictorial but a pure functional expression.

Compare with this the philosophic principle. The monads are the only reals, active subjects of experience, simple and indivisible. The monad is real in the sense that it is a thing in itself, not that it is an object common to the perception of others. Monads do not interact. There is no space-time continuum common to them, shared by them, and also absolutely independent of them. The extension and duration of the universe, and the universe itself, are not external to the monad. The concept loses its perplexity if it be borne in mind that what the philosophic doctrine is expressing in precise terms is concretely realized in every conscious individual. A mind owns its experience and cannot transcend it; it knows no without. The plurality of the monads is infinite, because everything in the universe of a monad may be real, but to conceive anything real is to conceive a monad, that is, an in-itself existence. The intercourse between monads does not consist in interchange of substance or in reciprocity of action and reaction, but in active expression and sympathetic response. Intercourse is impossible unless the rhythm of duration of the monads is identical, and this is only possible where the type and range of activity are the same. Thus there is intercourse between human minds but no intercourse between mind and body or between mind and the individual cells of the body.

If we compare the concept of the monad with the concept of the atom in the classical Democritean theory, we see that the indivisibility which is the essence of each concept applies in the atom to its spatial character, in the monad to its temporal character. The monad is the concept of the unity and indivisibility of an active living experience. The paradox to common sense in the theory of the monads is the impossibility of presenting their plurality against a spatial background. We cannot speak of the size of a monad. There is no absolute size, either of the monad or for the monad. Magnitudes, temporal as well as spatial, are relative to the activity of the subject and to the range of its activity, its universe. Thus for the human monad magnitudes are determined, first by the body or instrument of its activity, second by the universe or range of its activity, and third by the rhythm of its duration, the tension of its actual moment of experience.

Let us then present the paradox of the philosophical principle, which depends on the relativity of magnitudes, in a parallel form to the paradox of the scientific principle, which depends on the relativity of movements. Suppose a human consciousness to exchange the rhythm of its duration for that of a microbe as revealed to us by a high-powered microscope, and to live two full years of the microbial duration in the rhythm of the microbe's life and then to return. He would have lived two years but would have been absent, say, two minutes. He would actually recover two years of real psychical time.

A paradox of this kind hardly seems strange because it is actually a familiar experience which attracts little notice. We often live through a dream of long duration which we are able to detect as corresponding

with only a few seconds of the rhythm of our waking life. What disguises the paradox is that we schematize our real life against a screen which we measure mathematically by reference to an object in experience and then apply the mathematical measurements to the life itself.

We mistake the significance of paradox when we try to explain it away as illusion or sophistry. Paradox indicates a higher truth and directs us in the search for it. The discovery by science that absolute simultaneity is not only practically unrealizable but theoretically indefinable is the exact counterpart of the philosophical doctrine that the monad is self-contained in its universe. The philosophical principle is then seen to be directly interpretative of the scientific principle. The physical universe, nature, the object of science, is not a thing or a collection of things, it is for science a mathematical formula, for philosophy a harmony, and in each case it is dependent on active functions and on infinitely adjustable conditions.

To the question, "Is there a paradox in the Principle of Relativity in regard to the relation of time measured to time lived?" the reply is, that the rejection of simultaneity alike in practice and theory involves a paradox for common sense and an antinomy for philosophy which cannot be explained as illusion or sophistry. The paradox is that in regard to time measured, any two events which for observers in one frame of reference are simultaneous, for observers in other frames are before and after. In regard to time lived it is that periods which for different systems are in a relation of longer and shorter, greater and less, or even whole and part, are for the lives in those systems one and identical. The paradox can only

be reconciled by the new way of thinking the physical reality of the universe, that is, by replacing the common-sense notion of thing and the philosophical concept of substance with the concept of monads, individual substances, active subjects of experience, whose different worlds express a common universe and a common truth whenever they correspond in their rhythm.

XV

DESCARTES AND THE RISE OF MODERN PHILOSOPHY

Voltaire, writing a century after Descartes, in the full splendour of the age dominated by the great discovery of Newton, in his incisive, caustic and witty manner, passes this judgment on Newton's great forerunner: "Descartes fit le contraire de ce qu'on devait faire; au lieu d'étudier la nature, il voulut la deviner. Il était le plus grand géomètre de son siècle; mais la géométrie laisse l'esprit comme elle le trouve. Celui de Descartes était trop porté à l'invention. Le premier des mathématiciens ne fit guères que des romans de philosophie. Un homme qui dédaigna les expériences, qui ne cita jamais Galilée, qui voulait bâtir sans matériaux, ne pouvait élever qu'un édifice imaginaire."

This, it is true, is only one aspect of Descartes's philosophy. There is another. Even Voltaire was ready to acknowledge that the "new method," the pushing doubt fearlessly into realms of opinion fortified by authority, the relentless application of the method of universal doubt in order to establish primary truths and principles, and the discovery of the unassailable starting-point, "I think, therefore I am," this new method heralded a new spirit and constitutes Descartes's title to be regarded as the father of modern

philosophy. To-day his claim is undisputed, and yet the intellectual world generally and with one accord has assented to Voltaire's disdainful rejection of his nature-philosophy. We are accustomed to sweep it aside as a baseless romantic fantasy. We may be amazed at its ingenuity and at its author's confidence; it may still appeal to the imagination; but it has completely lost the fascination it once exercised, and the intellectual mastery which held the human mind in its grip for a generation following its author's death.

The time has come, I think, to revise that judgment. The tree of knowledge has, since Descartes, put forth many branches. The sciences of nature have established themselves one after another and have extended indefinitely the range of activity open to the human mind in its exploration of the universe. The prospect into which we peer is wider and broader and profounder than the prospect which opened out before the early pioneers, and reveals secrets to us which it never entered into their hearts to conceive. There can be no question in this twentieth century of simply going back, of taking again an old standpoint, yet we are coming to see that there was a principle of paramount importance in Descartes's conception of nature, a principle which the great nineteenth-century builders of science neglected of set purpose, and affected to despise, and which we to-day are finding it essential to bring back. We are indeed witnessing to-day another fulfilment of the old prophecy: "The stone which was set at nought by the builders is become the head of the corner."

Let me state what I mean as clearly and briefly as I can. The key-note of Descartes's nature-philosophy, the pivotal idea on which his whole conception turns,

is the notion of system. For him it was only possible to interpret a law of nature by referring it to the system, nature, to which it belonged. Now the whole force of Newton's "hypotheses non fingo" is the refusal to admit the notion of system as a conditioning or limiting concept. Gravitation was an empirical discovery, and the formula of gravitation, the law of the inverse square, was conceived to apply universally. Its universal application could not of course be empirical, but by refusing to see any self-contradiction in the concept of the boundlessness of space and time, the idea of its universality could hold the ground in the absence of any irreconcilable phenomenon. It would be inaccurate to say that Newton assumed the absoluteness and infinity (in the ordinary meaning) of space and time, for Newton made no assumptions, he simply thought it entirely unnecessary to theorize about space and time. In other words, the universality of laws of nature required no hypothetical system of nature in order to rationalize them. It appeared to Newton natural and entirely non-hypothetical to suppose that space and time extend to infinity and are structureless. In the nineteenth century and in the interest of materialistic science, this rejection of system was definitely formulated in a philosophy. Herbert Spencer, in *First Principles*, propounded the theory of the unknowable. The intention of this philosophical theory was to emphasize the positive character of science by surrounding it with a penumbra, an obscure and murky region in which reason, helpless and bewildered with hopeless antinomies, could find no ground for the sole of its foot. With the coming of the theories of relativity all this is changed. According to Einstein's theory, the laws of nature themselves can only be

delivered from contradiction by referring them to system, and to conceive nature as a system is to affirm that the universe is finite, and to affirm a finite universe is to deny that space and time are structureless. We have travelled a long way from Descartes and his vortex system, but only to find that we can make no progress at all unless we recognize his fundamental principle. Science ought never to have let the principle go. The laws of nature are unintelligible save in so far as they enable us to construct and interpret the system of nature from which they derive their uniformity and universality.

Therefore in studying Descartes and his problems, in carefully noting his principles and analysing his conceptions of Mind, of God, and of Matter, we are not engaged on a purely historical research, inspired by a merely antiquarian interest, we are studying the principles which underlie physical science itself and which are its directing force. Albeit that three centuries separate his life and thinking from our life and thinking, his thought and his life are for us not merely a record, a what has been, a what was but is not, it is intimately part of our thinking to-day.

At any rate it is in this spirit that I wish to consider the life and philosophy of Descartes. We can no more cut ourselves off in our intellectual development from our history and regard our history as a past which is over and gone, than we can cut across our own individual life and regard our childhood and youth as having no part in the reality of our present.

In the quotation from Voltaire with which I began, you may have remarked the reproach against Descartes that he never quoted Galileo. There is a deeper meaning in this than may at first appear, and it conceals

a malicious intention. Galileo died in 1642, an old man of 78 whose latter years had been made wretched by the cruelty of the Holy Inquisition. Descartes survived him only eight years, dying in 1650 at the comparatively early age of 54. While, therefore, Galileo and Descartes are contemporaries, Descartes's active working years coincide with Galileo's old age and his trouble with the Church. Both were engaged in precisely the same line of research. Though not associated they were in every way fellow-workers. Galileo's genius shows itself in contriving experiments, Descartes's in mathematical, more especially in geometrical reasoning, but both are engaged on the same problem, the discovery of the mechanism of the celestial movements, and both are following the same method of free inquiry, the search for truth by interrogating nature without presuppositions. Descartes tells us in his *Discours de la méthode* that in 1635 (he was then 39 years old) he had finished and had actually sent to the press a work on which he had been for many years engaged. Its title was *Le Monde* and it was designed to be a complete system of physics, what was then called natural philosophy. At that time all natural science took the one simple form of mechanics. Descartes's idea was that the principle which underlies the celestial movements and which determines the order and rhythm of the world without, is one and the same with the principle which constitutes the life of the body and secures the due performance of its functions. For the world without and for the world within, the whole of the order and arrangement follows from the introduction of movement into a previously, or at least into a primarily conceived, immobile extension. This introduction of movement into extension he declared

must have been the unique and simple act of God in creation. God imparted the movement and the mechanics of movement did the rest. What, however, particularly commended itself to Descartes was the discovery which he thought he was able to demonstrate, that the Copernican hypothesis, if accepted in this form, did not involve the actual movement of the earth itself. His view was that there is no void. Descartes, being a geometer, did not need to imagine any stuff—ether or subtle matter—occupying the extension. The extension was itself substance. Wherever there is extension there is matter. This matter (extension), having received from the Creator movement, is whirling round in a vortex, and the earth, like a ship on the ocean borne by tide and stream, is itself at rest at the same time that it is being transported round the sun in the vortex.

Not until his book was in the hands of the printers did he learn, to his painful surprise, of the arraignment of Galileo before the Inquisition and of his condemnation and punishment for expounding the Copernican "heresy." Fortunately for us and for the world, Descartes was not one of those indomitable champions who defy authority and risk death rather than remain silent when they feel that their cause is true. Descartes not only had no inclination to be a martyr, but with absolute sincerity he wished to avoid the censure of the Church. He withdrew his book, not half-heartedly or with concealed resentment,—he suppressed it entirely. Some form of it was found among his manuscripts, and in 1661, eleven years after his death, it was published under the title originally intended but with the matter carefully revised and edited by his executors. When I say fortunately for us and for the

world this book was withdrawn and suppressed by Descartes himself I speak advisedly, for in whatever way we assess the loss, the gain was incalculably greater. For two years later, in 1637, Descartes produced the *Discours de la méthode*, one of the world's great books, and enriched the human mind with a new idea. Yet this wonderful book was presented with unaffected modesty, with diffidence and almost apologetically. Its full title was *Discours de la méthode pour bien conduire sa raison et chercher la vérité dans les sciences; avec la Dioptrique, les Météores et la Géométrie*,—the three appended treatises being described as illustrations of the application of the method. It contained nothing which came into conflict with the received opinion of the Church, it expressed absolute submission to the authority of Scripture and tradition, in all matters which concern the faith; and in consequence the Cartesian philosophy of the seventeenth century, in the attraction it possessed for philosophizing minds in the Christian Church, secured its triumph.

To understand this most important factor we must consider the peculiar circumstances, political, religious and social, of the times in which Descartes lived. In the first half of the seventeenth century there was civil war in England and there was civil war in France, yet at no period of history was there a more complete contrast in social conditions between the two countries. In England the struggle between political parties which led to the civil war and ended in the execution of the king and the setting-up of the Puritan Commonwealth, brought out the deep religious earnestness of the nation. The struggle had been between an old ideal of irresponsible kingship claiming to rule by

divine right, and a new ideal of personal responsibility and national godliness. In France, on the contrary, the struggle was purely dynastic; and the dignitaries of the Church, the Cardinals who formed parties and armed their adherents, were moved by secular aims. The contending parties in France were a loose organization of undisciplined armed bands, following leaders who had no settled policy, or rather who determined their own policy; least of all was there any ideal of establishing a reign of righteousness, a Kingdom of God on earth. Yet in France, during the anarchic period of the long Regency and of the wars of the Fronde, we may see the gathering forces of the intellectual society which is to enjoy its noonday brilliance in the early part of the reign of Louis XIV. Cardinal Richelieu in particular encouraged learning and attracted celebrated scholars to Paris. He founded the Sorbonne and the Académie française. He cherished the idea of reconciling the reformers by intellectual weapons alone without resort to pains and penalties. His was not an age of toleration, for toleration implies indifference, but the cruel forms of repression which had marked the first conflict of the reformers with the authorities, and which were to be revived again in France under Louis XIV., were then in abeyance. Richelieu wished men to be reasonable. If they would be obstinate and troublesome he made use of *lettres de cachet* to send them into exile or into prison; he did not break them on the wheel or burn them alive at the stake. It was at Richelieu's palace that the famous general Jean de Wert made the remark that what astonished him most was to see in this most Christian country all the saints in prison and all the bishops at the comedy.

Descartes did indeed live in Holland during twenty of the most active years of his life, in voluntary exile, but his retirement was for the purpose of peaceful study and not to escape persecution. He wanted to live near a university for the advantages of research, but he also wanted to be free from the restrictions of university life. As matter of fact, Descartes did not come into conflict with the Church in any way whatever throughout his life.

René Descartes was born in 1596, at La Haye in Touraine, the third son of one of the noblesse or landed gentry of France. His mother died shortly after giving him birth. When 8 years old he went to the Jesuit school at La Flèche. He was feeble in health and at no time of life was he robust, and this, with his love of comfort and repose, contributed to form in him habits of seclusion and meditation. It seems a little inconsistent with this to find that when he has to make choice of a profession he decides for a military career. In effect, however, this gave him the means of gratifying his two strongest desires, to have leisure for meditation and to have the opportunity of travel and seeing the world. "Bene qui latuit, bene vixit" was his motto. At the age of 21 he took service as a volunteer in the army of Prince Maurice of Nassau. It was a time of peace, and he remained with the army two years in Holland. Then the dispute arose over the election of the Prince Palatine, husband of the Princess Elizabeth, daughter of our James I., to the kingdom of Bohemia. Descartes, moved by the desire to see active service, enlisted on the Imperial side and against the Elector. The Princess Elizabeth became in after years his devoted disciple, and the *Principia Philosophiae* is dedicated to

her, and was indeed composed at her request. It was during these campaigns that he formed the habit of secluded study and meditation which led to the formulation of his philosophical method and principles. It is less extraordinary than at first it seems. Campaigning took place only in the few summer months, and for the greater part of the year the army was in comfortable winter quarters. Moreover, Descartes's service was purely voluntary, he received no pay. The nominal sum he had to accept on appointment he kept as a curiosity. In 1621 he quitted the Imperial service and went on an extended tour, taking in Rome and Venice. He returned to visit his father, who had married again, and with his father's consent he arranged to sell his inheritance in order to invest the proceeds and provide himself with an income. The next few years were *wanderjahre*, till in 1629 he settled in Holland, and remained there, though not in any fixed abode, for the following twenty years. Three times he visited Paris. On one of these occasions he went to see Pascal, who had gone there to consult physicians for his health. Pascal's sister Jacqueline has described this visit in one of her charming letters to Mme. Périer, and gives incidentally an intimate glimpse into Descartes's personal character. " Monsieur Descartes venait ici en partie pour consulter le mal de mon frère, sur quoi il ne lui dit pourtant pas grand'chose; seulement il lui conseilla de se tenir tous les jours au lit jusques à ce qu'il fut las d'y être, et de prendre force bouillons." In 1649 he yielded to the importunity of another royal pupil, the young Queen Christina of Sweden, and was induced to take up his residence near her court in Stockholm. The rigour of the climate tried him severely, and, unfor-

tunately, Queen Christina's routine interfered with his habit *de se tenir tous les jours au lit jusques à ce qu'il fut las d'y être*. The Queen wanted her lessons at five in the morning. Descartes contracted a severe cold, followed by inflammation of the lungs, and after a few days' illness he died, in 1650.

Descartes had made a friend in his school days to whom he always remained closely attached. This friend, Marin Mersenne, was eight years older than he, and predeceased him two years. Mersenne occupies an important place in the intellectual life of Europe in the first half of the seventeenth century. He was rigid in his orthodoxy, and in 1611 he entered the order of Minim Friars. In 1620 he settled in Paris at the convent of L'Annonciade. His cell became the meeting-place, and he himself became the medium of communication, for distinguished mathematicians and men of learning in all lands. Himself a mathematician of distinction, he was keenly interested in the scientific discoveries of his time, and it was through him that Descartes submitted his *Méditations* for the consideration and comment of the principal leaders of philosophical thought.

The striking thing about Descartes's philosophy is that it does not emerge as a new form or development of what has gone before; it seems to flash on the world as a sudden and unexpected discovery. Moreover, even in Descartes himself it does not appear first in a tentative form and gradually assume its full development. The idea of his philosophy sprang, as it were, full-grown and ready-formed before his mind like Athene from the brain of Zeus. The evolution of Cartesianism was the work of his followers and successors, few of whom had known him or come under

his personal influence. The whole conception,—the new principle, the new method and the conclusions to which they led,—is contained in the *Discours de la méthode*. The arguments are elaborated in the six *Méditations*, and discussed and expounded in the replies to the objections he received; his physical theory takes the form of a complete treatise in the *Principes de la philosophie*; and his psychological theory of the animal spirits and of the relation of the soul and body is set forth in detail in the *Passions de l'âme*; but the philosophy itself, the conception of a new method in the search for truth and of a new criterion of clearness and distinctness in the idea as the test of truth, with the results to which the philosophy leads, are completely set forth in the *Discours*. The two larger and systematic works are really discussions of detail, elaborations and illustrations and applications of the philosophy.

In all his writings he is careful to disclaim any intention of challenging the authority of Scripture or ecclesiastical authority in matters which concern the Christian faith, and in the closing section of the *Principes* he expresses this disclaimer in words which are often quoted as an instance of ironical or insincere evasion. " Toutefois, à cause que je ne veux pas me fier trop à moi-même, je n'assure ici aucune chose, et je soumets toutes mes opinions au jugement des plus sages et à l'autorité de l'église. Même je prie les lecteurs de n'ajouter point du tout de foi à tout ce qu'ils trouveront ici écrit, mais seulement de l'examiner, et de n'en recevoir que ce que la force et l'évidence de la raison les pourra contraindre de croire." In my view these words are perfectly sincere and express the genuine attitude of Descartes to the problem of the

relation of reason to revelation. I think that those who think otherwise not only do injustice to Descartes but simply fail to appreciate the mentality of the seventeenth-century philosophers and its conditions in the historical development of knowledge. All the great Cartesians, not excluding Spinoza, besides their philosophical concept of God, accepted as historical fact the revelation on which the Christian religion is founded, and acknowledged the authority it conferred. What they claimed was that the search for truth in physical science is essentially and purely an exercise of reason, not of faith.

Descartes was a distinguished mathematician when he began to philosophize, and it was his mathematical researches which gave the characteristic mark to his philosophy and determined both its principle and its method. When he adopts as the criterion of truth and the compelling force of belief, the clearness and distinctness of the idea, it is the mathematical ideal demonstration, especially as employed in geometry, which he has in mind. We still name after him the Cartesian co-ordinates,—the three lines drawn perpendicular to the three spatial dimensions which enable us to fix the position of any point in rectilinear space and determine the direction of any moving particle at any moment. Also we owe to Descartes the first idea of defining a geometrical figure by means of the movement which generates it. So when he turns to the principles of philosophy, the method of doubt which he formulates in maxims or *regulae*, is precisely the method which finds in mathematics its illustration and its justification. It is the only method if our aim be to attain to first principles. It leads Descartes himself at once to an absolute basis, to a fundamental

affirmation which refers to nothing outside itself for its demonstration. I think, therefore I am. In thinking, even though in thinking I am doubting, even though in doubting I make my own existence the thing doubted, existence is affirmed. On this secure foundation Descartes bases his first philosophical demonstration. The mind exists, it is a thinking substance, a thing that thinks. In what, then, does the certainty of this proposition consist? Why must I believe it? Because, he replies, it is a clear and distinct idea. It is a proposition so transparent that it takes possession of the mind with the intuitive directness of a geometrical demonstration. I do not have to measure the radii of a circle one by one before I can know that they are all equal—I see it intuitively by the way in which the circle is generated; so likewise with the idea of the existence of my own mind or soul.

It is generally conceded that this discovery of an affirmation which is absolute inasmuch as to doubt it is to affirm it and to deny it is to make the idea inconsistent and self-contradictory, is Descartes's great achievement. On the pedestal of the modern statue erected to him in Tours is inscribed, " Je pense, donc je suis."

There are two grounds on which it seems to me we are right in ranking this starting-point of Descartes as of supreme importance as the foundation of philosophy. The first is that it does homage to the principle that philosophy must not start with hypotheses and cannot build securely on assumptions. And the second is that it bases the identity of knowing and being on an intuition of reality. It seems to me impossible to exaggerate the fundamental importance

of these principles, for they serve to characterize philosophy as a method and doctrine. As matter of fact, no one has challenged the starting-point so far as its truth is concerned, but many philosophers have disputed its value, and only few have admitted it as a necessary first step in any philosophical advance. What to me seems to show the amazing genius of Descartes is not so much the discovery as the use he is able to make of it. Very little attention has been directed to the second step in Descartes's argument, the proof that God exists. To my mind it is the crucial argument, and I will make this my excuse for speaking of it with some attempt at precision.

Because Descartes has introduced the well-known argument which we name the Ontological proof and associate with Anselm,—the argument that the idea of God is the idea of a perfect being, and such an idea must include existence, and therefore, since we have the idea, God exists; and because this argument has been continually both before and since Descartes affirmed, rejected and reaffirmed; philosophers have looked on it with indifference and have often failed to see the entirely new ground on which Descartes places it, and the peculiar force it derives from its connexion with his first position, " I think, therefore I am." That first position, even though we grant it to be unassailable, must be useless if it does not prove to be not only a secure position but a first step in philosophical construction. Yet it has been reached by a method of doubt which has eliminated every conceivably doubtful proposition. It may be a secure position, but will not every departure from it be a return to the region of doubtful ideas from which

we have with difficulty escaped? Descartes realizes this with his whole mind. What is it, he asks himself, which constitutes the absolute confidence I place in the intuition of my own existence? The existence I affirm of myself in thinking is an idea in my mind. In possessing the idea of the I thinking I affirm the existence. There is, then, an idea which includes existence. But is this the idea of perfect being? Clearly not. I who think am not all existence, my idea is of a being who is not perfect being. I am finite not infinite, dependent not self-subsisting. But in recognizing the finiteness of my being I see that I have in my mind the idea of perfect being (perfect, that is to say, in the meaning of all-including, self-sufficing,—not necessarily implying any moral attributes). This idea of a perfect being includes existence, otherwise it is meaningless and self-contradictory even as an idea. This idea of perfect being is the idea of God, therefore God exists. Let me quote his words in the third *Méditation*: "If I were independent of every other existence, and were myself the author of my being, I should doubt of nothing, I should desire nothing, and, in fine, no perfection would be awanting to me; for I should have bestowed upon myself every perfection of which I possess the idea, and I should thus be God." The argument that God exists is the simple corollary of the "I think, therefore I am," and closely bound up with it. It is Descartes's discovery not only that he has a secure position but that advance is possible. He has a sure beginning which will not, as it seemed to threaten to do, enclose him in a stultifying solipsistic subjective idealism.

These two arguments of Descartes are therefore

in effect one argument, and, taken together, they are the affirmation of mind or thinking substance. In the case of myself and of God what the argument has demonstrated is the existence of mind, not the existence of body nor the existence of the world. He now proceeds to develop his theory of the structure and mechanism of the physical universe. This, as we have said, was the inspiring motive of his whole philosophy.

He takes the world to be the creation of God. This is not an assumption but rather a necessary inference. God is the idea of perfect being and the source of all derived existence, inasmuch as the idea of God contains existence. Yet I have also, Descartes reflects, an idea of the external world, an extended reality, an attribute of extension which I cannot separate from the idea of the world. This idea does not contain existence, it is not the idea of the world which compels me to believe it exists. I am compelled to believe it because it is a clear and distinct idea in my mind. Its existence is presented to my mind, and there is nothing in the idea to assure me that an existence corresponds to it. Yet the idea can only come from God, for it is innate in my nature, and it is inconceivable that in the matter of clear and distinct ideas, or, as we might perhaps interpret it, in the matter of natural intuition, God can be deceiving us. If we to-day find this position unsatisfactory it is because problems unknown to Descartes have arisen. From this position he proceeds to inquire, what are the principles which God has followed in creating the world? It is reasonable to suppose that the All-wise will choose the simplest means which will effect his design. Thereupon he develops his system. The

world consists of two things—extension and movement. In no irreverent spirit but in profound admiration of the discovery that infinitely complex ends arise from absolutely simple beginnings, he says: Give me matter and movement and I will create the world. It was a magnificent idea, showing the grasp of a master-mind. Till then every materialist or natural philosophy had followed Democritus and held that the ultimate constituents of the world are atoms and the void. Descartes proposes a complete revolution. He criticizes the old concepts, to find they are riddled with contradictions and absolutely unworkable in physical science. Atoms are inconsistent with the first principles of geometry, and the void is a self-contradiction. How can it be the void if it have the attribute of extension? The great argument which had seemed to necessitate the concept of the void had been that unless there were void, movement is impossible; that a plenum implies impossibility of movement, for a condition of movement is that the thing moved shall have an unoccupied place into which to move. Descartes reverses the argument. It is void which makes movement impossible, because it makes propagation from point to point inconceivable by reason of the absolute breach of continuity. A force would be required at every moment to initiate a new movement. Movement is only possible in a plenum, but in a plenum the movement is a vortex, for there must be instantaneous displacement, the last member of the series must displace the first member of the series and replace it simultaneously with the displacement of the other members. Now Descartes rejects the idea of force because it is an obscure and confused idea, a scholastic concept for hypostasizing the unknown. In contrast

with it the idea of movement is clear and distinct. It makes it easy to comprehend the act of creation. For if movement is imparted to extension, then of necessity it must give rise to a world.

Let us now look at the application Descartes makes of the principle he claims to have discovered, that movement is a constant quantity. By a purely geometrical process, mechanical and automatic, the objects of the natural world will be generated. To get the idea, imagine a solid homogeneous mass of disintegrative material, packed into a continuous space which it occupies uniformly with no interstices between its constituent parts. Then suppose that movement is imparted to it, meaning, of course, that movement is introduced into the mass, disturbing its constituent parts, not that the mass itself is translated,—what will happen? The first effect must be fission within the mass along rectilinear lines. It must be rectilinear because the mass is a plenum, and spherical constituents at rest will not form a plenum; only rectilinear constituents, cubes not spheres, will do so. But the movement must itself change the constituents to a spherical form. How will it do so? It will cause the breaking off and grinding down of the angles of the rectangular constituents, and by doing so will create two kinds of matter, one kind spherical, the other a dust or subtle matter from the débris. This subtle matter will continue to undergo the same process, so that the tendency will be to infinitely small spheres. This, according to Descartes's scheme, is the first great result of the act of creation. Two kinds of matter are formed—one kind comparatively gross, the other comparatively subtle. Then he conceives that the effect of the great vortex will be a

separation of these two kinds of matter. The subtle matter will escape through the moving spheres and collect at the centre of the vortex. Thus are produced the sun and the firmament. The sun consists of the subtle matter, the firmament of the spherical matter, and all are whirling round in the great vortex. He now has to account for the earth and the other planets. The sun-spots give him the clue. He supposes that on this subtle matter a scum will be formed like foam on the sea, and this will tend from its viscous nature to grow in consistency, it will be a third form of matter. It will have no movement of its own but be carried round like a stone in a sling, till it gains momentum and is released. It will fly off from the sun into the firmament, cleaving its way in a straight line till its momentum is lost in an orbit of the vortex. It will then be a planet carried round by the whirling stream of the firmament in a fixed orbit. Or it may be a comet carried right out of the vortex to be captured by another solar system. Such is Descartes's philosophy of the Copernican theory. The whole conception hinges on one simple principle which we might call that of the conservation of movement.

From the world Descartes turns to the consideration of man, and the same principle is applied. Let us suppose, he says, that God should have moulded clay images of bodies like ours, giving them not only our outward form but also all our inner organs; they would then be clay machines, like a watch with its wheels and springs. Suppose then he were to introduce movement to these machines, they would function like our bodies; they would eat, move, reproduce their kind, as we do, purely mechanically. Descartes declared that animals are nothing more than such

purely automatic machines, and the only difference in us is that in addition to our living body we have a rational soul. But so far as all vital processes are concerned they are simply the consequence of indestructible movements. The mechanism indeed was marvellously contrived. The heart he conceived to be a great spring dilating and contracting by heating and cooling (Descartes did not know that the heart was a force-pump), the blood flowing through the arteries and veins and the subtle animal spirits mounting from the heart to be received in the ventricles of the brain and thence distributed by the nerves to the muscles, which by their inflation and deflation are made to move the limbs.

Joined to man's body is a thinking soul. This was in some way, which Descartes failed to explain, a purely directing force so far as the activity of the will is concerned, and a purely passive receptivity so far as intelligence is concerned. This soul is inextended, it constitutes our rational nature, our power to have ideas and to feel and to will. The movements of the external world stimulate the sense-organs of the body by their excitation and produce movements which are propagated through the animal spirits, which flow in the nerves, to the brain. These movements, in passing through the seat of the soul, which he thought to be the pineal gland, affect the soul, and its affections are sensations and ideas. Unlike the body, the soul is immortal. By our soul we are able to contemplate the world as God contemplates it, but our soul is no part of the mechanism even of the body to which it is joined. The mechanism of the whole creation is a function of its extension and of movement.

Such is Descartes's scheme of the generation of

the world out of the simple mechanism of movement. Advancing science soon brought the discovery that the principle was inadequate to comprehend the complexity of the real. Even to Descartes's immediate successor and faithful follower, Malebranche, the new invention of the microscope and the discoveries of Swammerdam and Leewenhoek have made it clear that our world, including plants and animals, cannot be completely accounted for by purely mechanical laws. Descartes's theory is only acceptable in the infancy of physical science; indeed it gives us the impression of ourselves assisting at the birth. Science for Descartes has only two branches: mathematics, which is reducible to the geometry of extension, and mechanics, which is reducible to the laws of motion. To the generation which succeeded him, Le Monde of Monsieur Descartes is a romantic, fantastic construction. " J'adore ses tourbillons," exclaims a young lady in Molière's *Femmes savantes*. With the advance of science Descartes's system seemed to come into conflict with experimental facts and even to be an obstruction to progress. Descartes himself was disconcerted by Torricelli's discovery of the vacuum formed by the fall of the mercury in the tube sealed at one end and the other plunged in the bath, the discovery which led to the Puy de Dôme experiment and to Pascal's demonstration of the weight and pressure of the atmosphere. This seemed at first plainly inconsistent with the theory of subtle matter. But it was in 1686, thirty-six years after Descartes's death, that Newton published the *Principia Philosophiae*, which absolutely and finally discredited the whole vortex theory. From that time until our own day Descartes's nature philosophy has appeared the outstanding example of the vanity of

philosophical constructions in contrast with the enduring foundations of a science built up by inferences from the patient observation of fact.

To-day, however, we are witnesses of a great and startling revolution in science. The invention of the spectroscope has brought, just as formerly the invention of the telescope and the microscope brought, an entirely unlooked-for revelation to the human mind of the constitution of the physical world. And what is more important even than the new conceptions it has given us of the structure of our world, the new science has compelled men to come to terms with the old philosophy. We have been driven back on first principles.

When we compare the theory of Descartes with the theory of Newton we find that behind the imagery which each has to use to express his concepts—Descartes's vortices and subtle matter, Newton's attracting masses—there lie certain definite concepts which serve as guiding principles. The fundamental idea of Descartes is that the movement of a body is determined in its velocity, its direction and its destination by the geometrical constitution of the system in which the movement takes place. Movement implies therefore a structure of the extension or space in which it occurs; and if we suppose that in the absence of movement this extension is structureless, then the introduction of the movement will itself generate a structure. The fundamental idea of Newton, on the other hand, is that space essentially is and must always remain structureless, because its very concept is a negation or deprivation of structure. The velocity, direction and destination of a moving body is determined by an influence of masses exerted on one another, an influence which is determined by an

attractive force possessed by the masses and measurable in terms of their relative magnitudes and distances. Newton's triumph was not due to a logical or metaphysical argument but to an empirical discovery which enabled him to formulate a universally valid law, the law of the inverse square.

As every one knows, within the last few years Einstein has successfully challenged Newton's theory of gravitation. He has demonstrated that the law of the inverse square is not universally applicable and absolutely precise, but only an approximation which holds good for relatively low velocities. Now the spectroscope has brought within the range of experimental control enormously greater velocities, and for these Newton's law does not hold. As simple, plain matter of fact, the planetary movements of the solar system are so accurately conformable to the law of the inverse square that we are able from the present condition of the solar system to reconstruct its history and foretell its future. The discrepancies, which have been known for a long time, are so infinitesimal as to be practically negligible. But if we apply this same law to the solar systems of atomic dimensions which the spectroscope has revealed to us, it not only will not account for the movements of the electrons in their orbits, but it is quite inconsistent with the stability of the atomic systems. This is the present scientific problem. To solve it mathematicians and physicists to-day are finding it necessary to call in question the fundamental principles which underlie scientific interpretation—in particular, to reconsider the problem of the nature of space and time. The theory of relativity has changed the basis of Newton's world, and the new doctrine of a four-dimensional

space-time continuum with its warping or curvature in the presence of rotating matter and the generation of fields of force, is curiously, in its main features, an almost exact return to the original famous vortex conception of Descartes.

I will just mention, without attempting to explain in detail, the quite recent interesting suggestion of Sir Oliver Lodge, that the electron may be moving in an orbit which is not determined by its own movement but by the vortex stream in which it is caught, in precisely the way in which Descartes said the earth was at rest in its orbit though translated by the vortex stream round the centre of the vortex or the sun. This suggests also a possible interpretation of the quantum theory and its apparent contradiction of the principle of continuity. The disturbed electron would on Descartes's theory move to its new orbit in a straight line, perpendicular to the direction of the vortex, in the way which he illustrated of the movement of a stone released from a sling.

In conclusion, I claim for Descartes a pre-eminent position in the history and evolution of physical theory as well as his unchallenged position as the father of modern philosophy.

It was Descartes not Newton who was the first to conceive the laws of nature as one and the same for the celestial movements and for terrestrial movements. It is true he did not deduce a law of movement by actual measurements as Newton did, but it is the fact that by his concept of the vortex he grasped the principle which alone can interpret the concept of a universal law—the principle that the world is a system.

To Descartes also we owe the formulation of the

laws of motion which usually bear Newton's name —the law of inertia, the law of rectilinear motion, and the law of the equivalence of action and reaction which he expressed as that of the indestructibility of movement.

XVI

THE TERCENTENARY OF PASCAL

No one can read the story of Pascal's life without amazement at the greatness of his genius and sadness at the mode in which it found expression. To Voltaire in the eighteenth century he is a " fou sublime, né un siècle trop tôt." To Chateaubriand in the early nineteenth century he is " cet effrayant génie, qui, à cet âge où les autres hommes commencent à peine de naître, ayant achevé de parcourir le cercle des sciences humaines, s'aperçut de leur néant et tourna ses pensées vers la religion." He lived at the beginning of the brilliant leadership of France in the intellectual development of Europe. In his short life he did notable work in mathematics and physics, and above all (to continue the quotation from Chateaubriand), " toujours infirme et souffrant, fixa la langue que parlèrent Bossuet et Racine, donna le modèle de la plus parfaite plaisanterie, comme du raisonnement le plus fort."

To appreciate the greatness of Pascal and to discern the leading motive in his wonderful activity, it is necessary to enter sympathetically into the spirit of the age in which he lived, and particularly to understand the nature of the religious influence which peculiarly affected him from infancy to maturity.

The outward circumstances of his life may be recorded quite briefly. Blaise Pascal was born at Clermont in the Auvergne on June 19, 1623. His father, Étienne Pascal, was King's Councillor and Magistrate, president of the *Cour des Aides*. He had two sisters, Gilberte, three years older, and Jacqueline, two years younger than himself. Their mother died when Blaise was 3 years old. In 1631 the father retired and settled with his family in Paris for the sake of their education. In 1638 he had managed unfortunately to incur the displeasure of Cardinal Richelieu, and, having good reason to fear a *lettre de cachet*, had to go into hiding. He returned home, however, risking arrest, when he heard that his dearly loved daughter Jacqueline was suffering from small-pox, and he remained constantly with her until her recovery. The following year there was brought about a reconciliation with the Cardinal, and shortly after he received the appointment " Intendant pour les tailles de la généralité " at Rouen, to which city the family then went to live. In 1648 the " Intendants " were suppressed by Mazarin, and the Pascals returned to Paris. The following year they went back to their native Clermont, where Gilberte, who had married her cousin, Florin Périer, was already settled. In 1651 the father died. Blaise, devoted to his sister Jacqueline, had hoped that after the father's death she would continue to make her home with him, but she had already formed her resolution to enter the religious life, and would not be dissuaded from taking immediately the austere vow at the convent of Port Royal.

The four following years are described by Blaise as his " mondaine " period. He sought distraction in travel and society, but in 1655, after a mental crisis

which is described as his second conversion, he decided to retire and devote himself entirely to religion. From 1658 till his death in 1662, although not bedridden or incapacitated from attending to his ordinary wants, he was so weak and in such continual pain that he could do no consecutive work. Jacqueline died in 1661. Blaise in his last illness was nursed by Gilberte. He died in her house. When the end was approaching the doctors attending him were assuring him that there was no danger, and refused to call in the priest. Pascal was in anguish lest he should die without the sacrament, but Gilberte acted on her own initiative just in time. She lived to be 67, and had five children. She wrote the life of her brother, and also a life of her sister Jacqueline.

Blaise Pascal was educated by his father, and had no other tutor. He never entered the university. All his acquaintance with the intellectual movements of his age, with its science, its philosophy, its religion, was derived directly from his father and conversation with his father's friends. On the other hand, at his father's house he met the most distinguished mathematicians and theologians of the time. Étienne Pascal did not merely supervise his son's education; he undertook it alone and unaided in order to follow out a predetermined method, which reminds us, alike in its conception and in its consequences, of the analogous case of the father of John Stuart Mill. One part of the scheme was to concentrate the boy's mind during his earliest years on perfecting his knowledge of his own language. His lessons were limited to the grammar and syntax of his native French, and the teaching even of Latin was deferred until these had been acquired, in the expectation that the new task would

then be comparatively easy. The other part of the scheme was to defer mathematics, indeed to forbid the study of it, until the acquirement of languages was perfect. The reason of this is curious. The father was not only himself learned in the mathematical sciences, but also had given his daughter Gilberte thorough instruction in them, yet he feared for his son that they would prove of such absorbing interest that he would be distracted from the study of languages. When the lad was 12, however, the father discovered that he had acquired, apparently surreptitiously, an acquaintance with geometry which amounted to precocity. He was found one day demonstrating for himself with *barres et ronds* the 32nd Proposition of Euclid's first book. We are told that after this he was allowed to read Euclid, but only in his recreation hours.

Not less powerful than the parental influence was that of his sisters. For their education also the father had original ideas. He did not himself undertake it, but they were educated by a man as men. Their tutor was a Monsieur de Mondory, in favour with the Cardinal and the Court. Jacqueline was an extraordinarily precocious child. She was a very pretty girl before the small-pox destroyed her beauty. She wrote verses from the time of her early childhood, and when 14 composed a comedy in five acts. She was deeply religious. One of her poems is a hymn of gratitude to God for her recovery, and she describes the scars left by the disease as the impressions of God's seal. She no doubt regarded this illness as a sign of her call to the religious life. Soon after her entry to Port Royal she was appointed sub-prioress, and she consulted her superior as to whether she should culti-

vate her talent for poetry. The reply of Mère Agnes, Arnauld's sister, is pathetic. "C'est un talent dont Dieu ne vous demandera point compte: il faut l'ensevelir." She signed the formulary imposed on Port Royal condemning the Jansenist doctrine under extreme pressure, though she struggled against it and wished to resist. "Je sais bien," she wrote to Dr. Arnauld, "que ce n'est pas à des filles à défendre la vérité, quoique l'on peut dire par une triste rencontre, que, puisque les évêques ont des courages de filles, les filles doivent avoir des courages d'évêques." Arnauld insisted, however, and the grief hastened her death.

To understand the religious fervour of the Pascal family we must also enter sympathetically into the spirit of the age. The seventeenth century shows in all its philosophy, and even we may say in its science, the influence of a deep personal interest in the problem of the relation of the individual mind to God. The reforming zeal of the sixteenth century had spent its force and been succeeded by the universal conviction of the reflecting believer that Christianity is much more than an institution based upon a verifiable historical revelation, that it is, in fact, a revelation in the philosophical meaning, an interpretation of human and divine nature. We only understand Pascal when we see that his religion is not ordinary piety or superstition, but profound philosophy.

Let us now look at the man himself. He is a younger contemporary of Galileo and Descartes. He survived both, but died before Malebranche or Spinoza had begun to write. This is peculiarly significant in appreciating his attitude towards the Cartesian philosophy, for Malebranche developed that doctrine along Augustinian lines which may have been actually

suggested by Pascal's writings. The illustration of *le ciron* to explain the relativity of magnitudes, expounded by Malebranche in the *Recherche de la vérité*, seems taken directly from a well-known passage in Pascal's *Pensées*.

Pascal agreed with Descartes in his doctrine of the soul, or thinking substance, with its corollary that the animals are automata, but he was revolted by the *Principia* and its claim to be able to explain the world by "figure and movement." "Quand cela serait vrai," he says, "nous n'estimons pas que toute la philosophie vaille une heure de peine." Notwithstanding his keen enjoyment of mathematical problems and his intense interest in physical experiments, the whole value of philosophy for him lay in the light it shed on moral problems, and on the power it gave man to interpret the Christian revelation. His point of view, while it accepts the principles of Descartes's philosophy, applies them in a way which makes his doctrine its very antithesis.

Descartes was shown the Treatise on Conic Sections which Pascal composed when 16, and refused to believe in its originality. He thought it the work of Desargues, from whom indeed Pascal had learnt much, but Desargues himself acknowledged the originality of Pascal's treatise in its essential points. In 1647 Descartes paid two visits to Pascal, who had come to Paris with his sister Jacqueline for medical advice. Jacqueline has given an account of their meeting in a letter to her sister Gilberte Périer. They discussed the question of the void. Torricelli, the pupil of Galileo, had demonstrated the phenomenon of atmospheric pressure by the famous invention of the barometer, inverting a column of mercury in a glass

tube closed at one end, with the other end immersed in an open mercury bath, and then measuring the height of the column. This was of course the crucial experiment, but there still remained considerable doubt as to its interpretation. To many, including Torricelli himself, it was merely a case in point of the old principle that nature abhors a vacuum. Descartes had rejected this principle on a priori grounds. Pascal explained to Descartes his theory of an ocean of air, at the bottom of which we were situated, and assumed that like all fluids it would maintain an equilibrium, and reasoned that above every point of the earth's surface was a column pressing down on us, the weight of which would vary with the altitude. He had already made experiments to prove this on a tower in Rouen, and he now proposed to carry out an experiment on a large scale on the Puy de Dôme in Auvergne. Descartes discussed it with great interest and foretold its success, although his reasons for the expectation were different from Pascal's.

The experiment was carried out by Florin Périer, and a full and detailed report of it was sent to Pascal. Two sets of apparatus were first tested side by side. One set was then carried up the mountain and the other left below in the Franciscan church at Clermont. The readings of the two sets were taken simultaneously by a pre-arranged plan and precisely recorded. The significance of the experiment in the history of science is its uniqueness. It was not an ordinary observation with a view to discovering scientific data, it was an experiment designed to test a theory which would stand or fall by the result. It had been known by practical engineers for a long time that there was a natural limit

to the action of a pump, and in Torricelli's original discovery it was suspected that the principle was the same as that which applied to the height of the water in the fountains of Florence. It was also supposed that the difference of the column of mercury from that of water was explained by the different densities. The problem was not the fact but its significance. The Aristotelians held that it had been definitely established that the atmosphere had no weight, and what is certain is that no means of discovering its weight, if it had any, then existed. It is strikingly analogous, therefore, to the modern case of the hypothetical ether when physicists were engaged in devising means of revealing its presence. Descartes, though entirely opposed to the Aristotelians, yet held on a priori grounds that the universe is a plenum. He needed this concept in order to explain vortex movement, which in his view accounted for the variety of material forms. The apparent vacuum of Torricelli's tube he supposed was an influx of subtle matter. Pascal, on the other hand, conceived the idea that this vacuum and also the known facts of hydraulic pressure are simply cases in point of a new statics which includes within one and the same principle the equilibrium of fluids and that of gases. It was this which gave to the success of the experiment its immense scientific importance.

Pascal's life divides naturally into three periods. To the first belong the mathematical works and the physical experiments, to the second the literary achievement of the *Lettres provinciales*, and to the third the philosophical and mystical *Pensées*. In all of them his great genius is manifest, and he might easily have been one of those master minds which

determine the direction of human thought. In science and philosophy he showed an intellectual power and incentive which place him on a level with Descartes and Galileo, yet he stands alone, grand but solitary, in the great intellectual movement of humanity. It was more than a religious act, it was typical of his whole intellectual position, when he joined the *solitaires* of Port Royal. We may count his unworldliness as loss or as gain, but he sacrificed for it alike scientific and philosophic leadership. The tragedy is that the Christian Church did not value what he gave to her when he renounced the world.

The works by which Pascal has immortalized himself are *Les Lettres provinciales* and *Les Pensées*. His mathematical works, like his arithmetical machine which took three years to perfect and is preserved at the Conservatoire des Arts et Métiers in Paris, are valuable for the evidence they afford of the nature of his genius rather than for their originality of discovery, but the two great literary works have been read in innumerable successive editions. Yet, strangely enough, both are valued and cherished for what to Pascal himself was purely adventitious and no part of the original design. The *Provinciales* are classical on account of their attack on the Jesuits and for the exposure of Jesuit casuistry. The world has little interest to-day in the Jansenist doctrine, which it was the main purpose of the letters to expound and to defend. Were it not for Pascal, the very names of Jansenius and Molina would scarcely be known outside narrow theological circles. The doctrine of sufficient grace has little more than antiquarian interest for students, but for Pascal it was the rationalizing of Christian doctrine, the philosophy of a religion of

redemption as distinct from the institution of sacraments and formularies founded on it.

The *Lettres provinciales* had an immediate success, but it is unlikely that they would have accomplished their design, or have afforded even a temporary cessation of the Jesuit hostility against the theologians of Port Royal, but for an event of an altogether different nature, and one which had a powerful influence on Pascal himself. This is what is known as the miracle of the sacred thorn. Pascal's niece, Marguérite Périer, was a *pensionnaire* at Port Royal, and the little girl suffered from an abscess of the lachrymal gland, which discharged into the eye and into the nose, causing her inconvenience and suffering. Medical treatment had proved wholly ineffective, but after having touched the spot one day with the relic of the sacred thorn, exposed for adoration on the altar, she was completely cured. The doctors certified that " la guérison surpassait les forces ordinaires de la nature," and the miracle was solemnly attested by the vicars-general of the Archbishopric of Paris.

Les Pensées was not designed by Pascal for publication in any form whatever. When he died a disordered mass of papers containing his written notes was found. They were unconnected, casual, jottings on odd bits of paper, many being incomplete sentences. It was known that Pascal had had in mind to write an " Apology " of Christianity, a defence against atheistical arguments. The editors took this as the clue to the arrangement of the fragments, and Arnauld, Nicole, and other leaders of Port Royal, after the " peace of the church," which restored them to their monastery in 1669, published the first edition of the *Pensées*. Few books have had such a success.

Edition has followed edition through the succeeding centuries. The original fragmentary notes still exist, and scholars may now study them in the *Reproduction en phototypie du manuscrit des Pensées de Blaise Pascal*, published by Monsieur Léon Brunschvicg.

XVII

HUMAN INTERCOURSE BY MEANS OF SPEECH

1. Life Experienced and Life Observed

The dramatist and the novelist, when they wish to give us privileged insight into the inner character of the personalities they create, adopt an artistic convention. The convention of the play is different from the convention of the novel, but in each case it is a pure convention. When the artist is a man of genius—a Shakespeare, a Molière, a Goethe or a Manzoni—we lose sight of the convention and feel ourselves transported into the actual life of the artist's creation; that is, it becomes as real to us as history. The dramatist's convention is to show us an action developing within the enclosure of four walls by removing one of the walls. The novelist's convention is to inform us of the thoughts which his persons are thinking and dispense with the need of making them express them in their speech. Of course, in neither case are we deceived by the convention. We are well aware that, constituted as we are, it is impossible to see through a wall, or to know the real thoughts which are inspiring the uttered words; but yet we think in each case that the convention is a natural one, supposing

only the raising of our ordinary powers in degree. Like Sam Weller under cross-examination by Serjeant Buzfuz we suppose that were our pair of eyes raised to the power of "double million magnifying microscopes" we might see through a flight of stairs and deal door. Even more ready are we to believe that with heightened spiritual powers we could directly perceive unuttered thoughts. If like Siegfried we could gain possession of the Niblung's magic ring, we should be able to discern the treacherous thoughts behind Mime's spoken words and understand the language of birds. Indeed, most of us have grown up in the imagery of a world peopled with spiritual beings —guardian angels and mischievous fiends—against whom stone walls and iron doors are no protection, and our first idea of God is of one to whom the secrets of all hearts are revealed. To many of us, "Thou God seest me" was our first definite teaching about the unseen world. We are more puzzled at the impediments which seem to interpose between minds and limit their intercourse than at the fact that there is such a thing as intercourse, and we are unconscious of any mystery surrounding its nature.

One of the first results of philosophical reflection when we direct it to the nature of our own life and personality is the discovery that not only in fact do we never pass out of ourselves, break through as it were into the outer world, but that every attempt to imagine such a break-through involves us in self-contradiction and absurdity. "If I were you" is always found to refer to the conditioning environment, and never, as in its first intention it appears to do, to the actual lived experience. It is always found to mean "If I were circumstanced as you appear to me

to be." There is no escape from the fact that the thinker is the centre of his universe of thought however much that thought may seem to set him free and enable him to roam in the vast universe. It is disconcerting. The illusion amazes us when we appreciate its extent. It also offends the dramatic instinct in us. We like to think of ourselves as capable of playing many parts—and how easy this would be were we, instead of being self-centred subjects of experience, carved out of some homogeneous indifferent stuff! So far indeed as ordinary knowing is concerned there appears no reason at all why the stuff of which our bodies are constituted should not be transitive, why it should not serve now one mind, now another. If only our mind were also a stuff there would then be no absurdity in conceiving one mind as becoming another. The identical atoms of carbon may be a diamond, the hardest known matter which nothing else can scratch, or a piece of graphite which will lubricate steel surfaces or mark paper, or a piece of gritty charcoal which will crumble to dust in the fingers; so in like manner if there were a mind-stuff we could conceive a complete change of personality, without any difference of substance. Our character would then depend entirely on circumstances, and all apparent initiative in activity would be simple reaction to environment dependent on accidental form and external stimulus.

It is otherwise. However attractive in theory mind-stuff may be, we cannot escape the conclusion that the very term carries with it its refutation. To try to conceive mind-stuff is like trying to imagine a round square. The fundamental notion of stuff is inertia and the fundamental meaning of mind is activity.

Each of us lives in his own private world which no other can penetrate, feels his own feelings which no other can feel, thinks his own thoughts which no other can think. Our activity may expand, and with it may extend the range of our effective action, but we never break through, never pass out of our own world into another's world, never cease to be self to become other. The very idea of an interchange of personal experience, if the mind itself is in question, is self-contradictory.

Yet though every mind is individual, self-enclosed in its universe, self-centred in its activity, self-referring in its experience, co-ordinating external phenomena from its own standpoint, there is intercourse between individuals. We are able and we do communicate with one another. We take counsel together. We express our experience discursively. We interchange ideas and we progress by mutual understanding and active co-operation. We recognize a common universe as the reality of our different perspectives. There is a problem, therefore, in the fact of intercourse. What is the nature of intercourse between individuals whose essential nature is that their experience is personal and uninterchangeable? What is language?

2. Language in its Scientific Aspect

The old Bible legend tells us that God when he had created Adam and placed him in the Garden of Eden brought to his notice the various creatures he had formed and made subject to him, and that Adam gave them names. This was the origin of language. The names, like the names which he afterwards gave to his children, indicated something definite and

characteristic in the nature of the thing named. In other words, names were expressive and definitive and to a certain extent arbitrary, for whatsoever Adam called the creature that was its name.

Another legend tells us that the different languages which men speak arose out of a confusion of tongues and was devised by God as a defence against the presumption and power of his creature man. It was designed as a means of dispersing the human race and preventing its concentration. It brought about a conflict of interests to counteract a co-operative effort.

The underlying motive of these legends is the need of explaining the diversity of language in view of the fact that the naming of things is a simple straightforward human act which, however arbitrary in the first instance, has a clear utility value.

A parallel to these simple-minded legends which satisfied mankind during long unscientific ages is often met with in our own scientific age, and many modern scientific theories of the nature and origin of language show little advance on the idea which underlies these primitive legends. That there are different languages and not one accepted universal language is often regarded as a nuisance which could be easily removed and which is only retained through irrational prejudice. And nothing is more common than to hear philosophers and men of science complain of the ambiguity of terms with the evidently sincere conviction that it would be a quite simple thing for men to agree on a set of pure signs to which absolute meanings could be attached. The belief of most people is that language is both artificial and adventitious, a human invention, and, like all mechanical inventions,

indefinitely perfectible. We suppose that reason has led us to devise and adopt a means of discourse and not that discourse is part of human nature and a condition of its rationality.

A very different kind of fact in regard to human language is revealed to us, however, in modern physiological science, and a very different concept of the relation of human language to the form of human activity and to the development of human knowledge is necessitated by modern philosophical theory. Language depends on the possession by the individual of a power of intimately co-ordinating an active articulation of sounds with a passive receptivity in the sense of hearing. The integrative function of this complex physiological structure can now be localized in the brain. A human child speaks as soon as its organism reaches the stage of development at which the co-ordination of its speech mechanisms comes into play. If a child does not speak or shows inability to speak, we no longer set it down to want of intelligence, we know there is a physiological defect or a structural abnormality and we know where to localize it. An ape or a dog brought up in human surroundings under the most favourable conceivable conditions of appeal to its reasoning powers does not speak, does not use the human method of discourse, not because it lacks intelligence but because it is not provided in its organism with the physiological disposition which alone would enable it to exhibit that mode of activity. We have then clear scientific evidence that we speak or discourse because we are organized to produce and respond to articulated sounds. Language is not an invention due to our reasoning powers but a product of evolution. Life has provided the necessary accom-

panying structure for the active function which discourse implies.

From the standpoint of psychology it is equally clear that language is wholly dependent on an internal psychical disposition, on what in psychological science we may be allowed to call a modification of the mind structure, and in no sense whatever on the mind's attitude to the environment. We have only to consider the case of the human infant to be convinced of the absurdity of all theories which make language depend on a reasoning process, however simple the reasoning and however direct the perception. It is quite inconceivable that the infant, previously to the period at which it begins to speak, can have been preparing the conditions of intercourse by its perceptual observations, its exercise of memory, and its logical inferences. The infant speaks before it reasons, and reasons because it speaks. Speech is a condition of reasoning and not vice versa. Mechanical articulation to produce the imitation of a sound heard is not speech and does not give rise to speech. It is sometimes thought to do so because the names which a child gives to many common objects are imitations of the sounds which proceed from or are associated with those objects, as when ox is "moo," sheep "baa," horse "gee-gee," but the child gives these names when and because it speaks, and the imitation is not mechanical repetition but active responsive articulation. When as often happens a child surprises us by the use of a grown-up phrase which is clearly beyond its understanding and therefore apparently a mechanical repetition, our amusement is not caused by the child's imitation (if we thought it was imitation we should resent it as rudeness), what amuses us is the child's

precocity in adopting an expression beyond its understanding. The impulse to talk which we all experience is never a stimulus of external observation but always an inner need of giving expression to our inward intuition. Were the infant's power of speech simply an ability to imitate natural sounds such as some birds possess, speech might come early but intercourse would tarry long. There is true discernment of the nature of language in the old Greek story told by Herodotus of the king who, wishing to discover the original language of mankind, had two human infants isolated and watched, in order that their earliest babbling might be recorded.

On the other hand it is not difficult to see why it is so commonly held that language is an artificial convention, in its origin a useful device, finally and generally adopted by mankind and handed on from generation to generation by the established habit of bringing up the child in the ways of its parents. Language is not only spoken words, it takes also the form of written signs, and in this form it has become a means of intercourse between individuals separated from one another in space and in time. Writing and reading are clearly artificial, and with difficulty acquired. They demand application and effort and are attained by the individual only after long disciplinary education, and they come late in the development of the race. Reading and writing are not intuitive or instinctive but intellectual and logical. In view of this artificial and conventional development of language it seems a natural deduction to suppose that language itself in its origin is artificial and conventional. It is a false deduction. It would be much truer to say of language that it arises out of a purely irrational instinct.

The only difficulty in so conceiving it is that language and reason are so inextricably related to one another that it would be equivalent to saying that reasoning itself is an irrational instinct. This is why the theory that language is natural, not artificial, sounds a paradox.

We may conclude then that language in the form of speech is a psychological function for which we possess in our organism the appropriate specific physiological structure. It is a mode of activity as natural to the human creature as any psychical characteristic such as herding, or hunting, or packing, or lying in wait, may be specific to any particular race of animals.

3. Language in its Metaphysical Aspect

When we consider an individual living organism, it presents to us, whatever be the stage of its temporo-spatial development, two aspects: it is a passive material object of our contemplation, and as such it reveals nothing whatever of its own reality; it is also an active developing object, interesting us not in what it is but in what it is doing, and as such its reality is not contemplated as an object but conceived as a subject with a self-directed activity revealing itself in purposed actions. It used to be thought that so far as science is concerned, whatever may be the case in speculative philosophy, the aspect of the individual as in itself an active subject of experience could be ignored, or at least that for all scientific purposes it is possible to make complete abstraction from it. The scientific ideal is often represented as being a rejection of everything which cannot be externally observed. The modern theory of Behaviourism, for example, is

apparently inspired by the conviction that such an ideal of pure objective externality is attainable and workable even in the science of psychology. The principle of relativity has come to teach us that it is an impossible ideal even in the most abstract of the sciences, mathematics. When we measure physical phenomena a condition of the measuring is that we have taken a frame of reference. To us as observers and for the purpose of our co-ordination that frame of reference is a system at rest, and from this standpoint of ourselves attached to a system at rest relatively to moving systems, we measure the celestial movements. But we now know that this system which is our frame of reference is not at rest, even when considered by itself and apart from its relations to relatively moving systems. We are attached to a system which is accelerating. For the observer attached to an accelerating system to be always attached to a system at rest, it is necessary that the dimensions of the system shall vary in order to maintain the ratios constant. That this is so in fact, that our three spatial axes and our time axis vary continuously in dimension to maintain a constant ratio, is the fundamental concept of the principle of relativity, in so far as it claims to be true of the physical universe. I want to point out what it implies in the nature of the signs which serve us as language.

Suppose an observer attached to a frame of reference, which for him is at rest relatively to other systems, to be able to communicate his measurements of some phenomenon to an observer of the same phenomenon attached to a frame of reference, which though at rest for him is moving relatively to the system of the first observer. If we raise the question in what sense can

any phenomenon be the same phenomenon for each, the answer with which we must be satisfied is that there may be sufficient correspondence for each to regard the phenomenon he observes as identical with that which the other observes and that he does so regard it. Our present inquiry concerns not the identity of the phenomenon but the means of intercourse. How are we to conceive the nature of the signals which will be for the communicating observers their language? According to our principle, for each observer the frame to which he is attached is at rest. (It is not necessary that the two observers should be different individuals, the same individual making observations at different periods in the progression of an accelerating system will be in a similar case—for example, an earth-dweller reading in June the measurements he had himself recorded in the previous December.) It is clear that whatever material objects are used for the signals which convey the information, they must undergo a transformation when they pass from one system to the other, for the meaning they serve to convey is necessarily different to each observer. They must, to serve the purpose of intercourse, be adaptable by each observer to the conditions of his observation. Let us take the simplest illustration—the simplest because it supposes the communicability of only the most abstract information. Let us imagine, as many writers of scientific romances have amused themselves by fancying, that there are in the planet Mars observers of nature like-minded to ourselves, and that we have mutually discovered a means of interpreting our communications. We know only one kind of physical phenomenon which we can imagine to serve as the means of communication, light flashes—these then will

be our language. But the Martians who observe our signals observe them conforming to their standpoint, viz., to the standpoint of their system at rest. We observe their signals and dispatch ours from our own standpoint of our frame of reference as a system at rest. The two frames of reference are different, and the signals dispatched to convey meaning must be transformed when received. The question is not whether under these circumstances intercourse is possible, we are supposing that it is, but the nature of the language. The material means of communication, in this case light flashes, is different and not identical for the two observers. If it is identical the meaning is different, and if the information received is identical with the information dispatched the material sign has been transformed in passing from one system to the other. In the restricted form of the principle of relativity this fact was expressed by saying that for every system of reference moving with uniform acceleration relatively to another the velocity of light is constant.

The monadic principle in philosophy is simply the generalization of this abstract fact and its application to the concept of scientific knowledge. The principle is that just as within the human world there are individual standpoints so there is for the human world itself a standpoint of human observation. As human beings we cannot free ourselves from the need of an active co-ordination of the universe, it is a condition of our agency in it, and it is in that need that experience arises. To co-ordinate the universe means that we shall be able to present it to our mind as independent of us and as external to us. Yet, though the universe presents itself to us in this objective form, we are unable

by any means whatever to discover in it an absolute criterion to which we can appeal and so free ourselves from the subjectivity attaching to our co-ordination of it by reason of the standpoint from which we observe. How then on the monadic principle, which declares that all co-ordination of physical phenomena is from within outwards, can there be science in the accepted meaning, namely, knowledge of a physical reality common to all observers? The reply is that science, to adopt a modern expressive term, is an extrapolation. We do not, as we have hitherto supposed, interpolate our science into a reality revealed to us in perception; on the contrary, it is science which extrapolates reality conceptually, and intercourse is the means of this extrapolation. Formerly we regarded the physical universe as the condition of intercourse between monads, now we are able to see that it is the inter-monadic intercourse which generates in us the concep of a common universe. It is because we can use variant signs to express invariant relations when transferred from one system of reference to another that we can give objective meaning to truth.

4. The Solidarity of Mind and Body

I now come to what seems to me is the real hindrance to a consistent theory of the nature of intercourse, namely, the idea that we can conceive mind and body as able to exist apart from one another. It is in my view inconsistent to say that a living organism, a human being for example, is a monad, if we hold that the twofold nature of the human being means that a mind, existentially distinct from the body, is united to it externally and perhaps temporarily. In my view

the human being in his twofold nature is the monad. In thinking the existential separateness of mind and body impossible, my concept of the monad differs in an essential point from that of Leibniz. To make my meaning clear I must refer briefly to the historical aspect of the problem of the mind-body relation.

The common-sense as well as the philosophical opinion of the relation of mind and body finds expression in the Christian doctrine of the nature of the soul. In the seventeenth century the Christian dogma lost its theological character and became a concept of philosophy. There is perhaps no finer expression of the rational rendering of the Christian belief than that of Malebranche in the Introduction to his *Recherche de la vérité*. Following St. Augustine and in full accord with St. Thomas Aquinas, he expounds the twofold nature of man as consisting in the union of a rational soul and a sensuous body. Reason unites man with God, and ranks him with other created minds in a spiritual hierarchy. The body unites him with the material world and determines the mode of his activity and limits its range in space and in time. The two natures are represented as a higher and a lower. Malebranche held, in common with all the Cartesians, that mind and body are existentially distinct, that the essential attribute of the one is exclusive of the essential attribute of the other, that the existence of the one in no way depends on the existence of the other. It was this dual existence which made the nature of their relation the main metaphysical problem in the seventeenth century. Descartes tried to prove that the relation was one of direct causal action. The occasionalists held that the

relation depended on a continual intervention of God. Leibniz held that there was no interaction of any kind but a pre-established harmony. By means of this idea of pre-established harmony Leibniz explained not only the relation of mind and body but generally the inter-relatedness of the monads. If the exchange of ideas between monads by means of conventional signs had presented itself to Leibniz as a special difficulty, there can be little doubt he would have taken language to be a case in point of the parallelism which for him was a universal principle. He was able to conceive this because in his view the skill of the divine artificer had no limit. In creation God had simply given existence to the scheme which omniscience had presented to the divine mind in idea. No such easy and first-hand solution is available to us of the modern scientific era, and if we reaffirm the monadic principle we must show it to be self-consistent, we cannot appeal to a transcendant cause. Even in Leibniz we meet with two quite different and mutually inconsistent conceptions of God. God is the creator of the monads, and also he is the supreme monad, the ruler of the commonwealth of spirits. There is also in Leibniz an inconsistency in the concept of the monad itself. The monad cannot be reconciled with a theory of dual existence. A human being in his unity and universality can be conceived as a monad, a constituent cell of his body may equally well be so conceived, but his mind or his body can no more be conceived each as a monad than his hand or his foot or one of his bones. The distinction is very important and the ground of it is perfectly obvious. A cell of my body may be conceived from its own standpoint as living its individual life, in that case I conceive it as in itself a monad, but I do not

conceive it as a monad in so far as it enters as a constituent into my organism. I cannot conceive my hand or my foot as monads, because there is no standpoint from which they can be conceived as individuals living their individual life. Apart from their function as part of my organism they are not hand and foot. This is the case, too, of mind and body; it is not indeed impossible to conceive them as monads, but if we do, it seems to me to make it impossible to form any scheme of their relation. On the other hand, if it is the living organism, mind-body, which we conceive as the monad, it can enter naturally into the monadic hierarchy.

The difficulty of understanding the nature and mode of intersubjective intercourse does not, however, appertain simply to the metaphysical concept of the monads and their interrelatedness. There is a difficulty in understanding how minds communicate, whatever be our theory of the nature of mind. The concept of the monad helps us only if it enables us to form the idea of the solidarity of mind and body. Intercourse is sometimes described as "the contact of minds." It is almost universally supposed that in rational intercourse, or the exchange of ideas, it is mind which communicates with mind, the two bodies being no more than the intervening means of the communication. The idea that mind and body are a conjunction enters deeply into ordinary thought and finds expression in ordinary language. We say of some one that he speaks without thinking, of another that he thinks and keeps silent, and the idea clearly is that the mind thinks, the body speaks, and in speaking is simply the mind's instrument. Yet physiological research uniformly negatives the possibility of

the existential separation of the mind from the body. At least it seems to me that all the crucial work, such as the investigations and experiments of those who, like Dr. Head, have studied the disturbance of intellectual functions consequent on structural injury, and of those who, like Sir Charles Sherrington, have experimented on the decerebrate animal, confirms the view that, wide as is the essential difference between mental and material phenomena, and difficult as is the problem of how they are to be correlated, not only are mind and body existentially one, but the essential difference between them depends on an existential identity.

To avoid misunderstanding let me make it quite clear that I do not mean that the relation of mind and body is, like the relation of the members of the body to one another, a relation of parts to a whole. I mean by solidarity essential difference and existential identity. Mind and body are essentially opposite in whatever mode we characterize their reality, but it is impossible to give meaning to any character of the one in abstraction from the relation in which it stands to the other. The seventeenth-century philosophers were right when they affirmed the difference of the essential attributes, wrong when they argued that this implied existential independence or, as they expressed it, dual substances, even when, like Leibniz, they conceived substance dynamically.

Also, in regard to the concept of the soul as immortal, the theory of the solidarity of mind and body is not inconsistent with the Pauline " faith and hope " that man's earthly existence is only a kind of chrysalis stage in a larger life.

5. The Scheme of Intermonadic Intercourse

When in place of the metaphysical abstractions mind and body, thought and extension, we conceive the individual living organism, the concrete fact, as a monad, we have then a concept which, so far from pointing a direction opposed to that of positive science, interprets science and reflects it. The problem of intercourse is transformed. Instead of devising a scheme by which men's minds communicate, though imprisoned within impenetrable bodies, we have now to understand how men, organized living beings, know and co-operate with one another.

For the scheme of intermonadic intercourse we can now turn to science and to purely empirical principles and need not appeal to metaphysics at all. Mathematicians have familiarized us with the notion of system. To measure the celestial movements astronomers must first choose their frame of reference. The perception of this condition is a consequence of the Copernican discovery. The earth is itself a celestial body moving relatively to other celestial bodies. If we take the earth as our frame of reference, then in our measurements we express all equations from the standpoint that it, whatever its own relative movement, is at rest. Astronomers, however, are not obliged to take the earth for their system, they can choose any other—the sun, one of the planets, a comet, or one of the fixed stars—but whatever frame of reference they choose they take it as a system at rest and measure all movements from that standpoint. And more than this, they can transform their equations so that what is true for them as observers attached to one system will also be true for observers attached to other systems,

the simple principle on which they proceed being that every observer attached to a frame of reference necessarily measures phenomena from the standpoint of a system at rest. It is easy to see that where, as in the case of our earth, the system is one which has acceleration, it must involve elaborate and complicated mathematical operations, but the principle is absolutely simple. It is precisely the same principle which the astronomer applies to world-systems that I propose to apply to explain the intermonadic intercourse. Every individual human being co-ordinates the universe for himself from a personal standpoint which is absolute. Each of us takes his own organic sense-experience as his standard of dimension, his criterion of reality and truth. The astronomer, dealing with worlds, is not concerned with individual standpoints within the worlds. For his purpose all who use the same world—all human beings, for example, who are attached to the earth-system—are observers in one identical system of reference. But individual experience requires in each individual an absolute inalienable standpoint, and puts all individuals in the same relation to one another as that which the world-systems have to one another save only that it is infinitely more concrete and less abstract. I, for example, am now writing words which are to express to you my ideas. In order that they shall do so they must be transformed for you who read them from what they are for me who write them, for to be effective they must express to you *my* ideas from *your* individual standpoint, and from that standpoint they are *your* ideas, not *mine*. Our intellectual nature makes such a transformation possible. You to me are an object in my visual space altering in dimensions, absolutely from my standpoint, as you

approach or recede. My reasoning power enables me to think of you as not altering in dimensions in yourself, simply by recognizing that you in yourself have an absolute standpoint such as mine, and that all interchange means the transformation from one standpoint to another, and the two standpoints can never be experienced together by any one observer. The pleasure or the pain I feel, the objects of my sense-perception, the thoughts I think, cannot pass from me to you in the form in which I experience them, but they can pass from me to you if in passing they can change from the form in which I experience them and assume the form in which you experience them. However difficult it may be to schematize the process of this intercourse, there is no mystery, certainly no inconceivability about it, so long as we are concerned with living organisms and not abstract minds. There is no mystery, because the organism is the self-expression of a living active principle. I possess the power of reflective self-consciousness. The nature and origin of this power may be wrapt in an impenetrable mystery, but having the experience, it is a natural corollary to discern its possibility in the objects which come within my perspective. It is no more than the astronomer's recognition that observers in moving systems may experience their systems as at rest.

6. Speech and Linguistic Art

Language stands to thought in the same existential relation as that in which the body stands to the mind. Words cannot be identified with thoughts; they are different in matter and in form, and opposite in the

kind of order which they present. Yet words without meanings, that is, words without thoughts, express nothing and therefore are not words, and thoughts without expressions are not thoughts, for thinking implies the seeking and finding of expression.

Human beings communicate by speech, and, as we have seen, there are in the human organism the special mechanisms which are designed and contrived to bring about this mode of intercourse. We can dissect out these mechanisms and discover experimentally the means by which sounds are produced and articulated. We can also break up speech into words and analyse continuous discourse into "parts of speech." But we cannot by these means discover how speech has acquired the significance which makes it language.

Speech is the counterpart of human reason, it is the external expression of an inner activity. Speech is human nature's characteristic mode of behaviour. The human articulation of speech follows the lines of the human articulation of the external world. Bergson in his theory of creative evolution has expressed the view that the human intellect is the special mode of living activity which the *élan vital* has evolved to serve us in preparing the peculiar form of action which our organism is adapted to actualize. If this theory be true, then the division of language into separate words and the combination of these words by us into sentences need be no mystery. The articulation of speech will reflect, as we should then expect, the articulation of the world. If the intellect geometrizes the world, what can be more natural than that it should geometrize speech, that expression of itself which is in organic connexion with it? This articula-

tion of the original unity would then appear as itself original and the unity pose as an after construction. Philosophy offers us the correction by presenting the human being in his full activity as a monad. The parts into which reflection seems to disintegrate experience are not the original constituent elements out of which it is constructed, but partial views of it, limitations and contractions and concentrations which have utility value in that they serve to direct and form actions. Thus discrimination of the sense-receptivity of the organism gives us the localization of special senses, but philosophical reflection shows us that the "manifold of sense" is not an original multiplicity but a work of active thought. The data of the various senses are not associated by the individual, but dissociated by his intellectual reflection.

According to this view of creative evolution the structures and functions of our organism have been contrived to fulfil the conditions of a certain mode and range of activity. In the case of the human being intercourse will appear as one of the ends which (to speak anthropomorphically) evolution has had in view, and articulate speech the advantage conferred on us by the intellectual mode of our activity. From this standpoint an interesting problem arises in regard to language. Is language, like tool-fashioning, a human invention? Did some individual man discover, by means of the intellectual powers which had been developed in him, that intercourse with his fellows could be improved by the mutual agreement between them to employ arbitrary signs as symbols of absent things? Is language an invention in the same sense in which, as every one would agree, the printing-

press is? If speech is natural to man, reading and writing are not. Philosophy can help us to give the answer. Bergson holds that the most definite distinguishing outward sign of intellect is the making of tools and the contriving of tools to make tools. If, only in so far as this illustration of tool-making is concerned, we accept his account of the difference between instinct and intelligence, namely, that the instinctive tool is organic and the intellectual tool a detached and artificial manufacture, we shall see that while language is part of human nature, closely and organically bound up with its rational character, the applications of language in developed spoken and written speech are inventions. We shall say then that though man is not the only creature who has need of intercourse with his fellows and possesses means of intercourse, the physiological evidence, so far as we can discover, shows man to be the only creature whose intercourse takes the form of articulate speech. Language is the outward form of reasoning or thinking. Reasoning or thinking manifests its superiority to other modes of activity by inventing, particularly by tool-making. This inventing, applied to discourse, has widened the sphere and opened the range of human activity, and secured and strengthened man's control of nature and supremacy in his world. And thus is harmonized the fact, so disconcerting in its first contradictory appearance, that language is natural to man, the inseparable counterpart of his intellectual mode of activity, while the modes of speech are artificial and their development a consequence of the power of invention with which reason has endowed him.

7. Conclusion. Functional Expression and Rational Invention

What I have been concerned to maintain in the foregoing considerations is, first, that intercourse between monads cannot be conceived as a form of mechanical interaction, and, second, that the origin of speech cannot be an intellectual invention.

As matter of fact, speech is a natural function of the human being, for the performance of which a special disposition of structures exists in his body and a tendency to a special mode of activity in his soul. Speech is the mode in which the human form of intellect and its capacity of reasoning finds expression.

All the biological theories of the evolution of man (I know of no exception) infer that speech must in its origin have been an invention. The usual inference is that a new race of Hominidae, at an early period of its emergence by evolution, discovered that natural cries could be adapted and modified and moulded into an instrument of discourse. In like manner all philosophies of language treat words as the conventional use of a material means of conveying meanings from mind to mind. In support of both these inferences, namely, the inference that language in its origin is an invention and the inference that discourse depends on material means, we are confronted with the fact that human speech has developed like an art and in its higher forms is artificial and manifests an inventive activity of a highly intellectual order. Against these theories the view I have put forward is: that invention is the distinctive mark of intellect, and that therefore it characterizes the development of speech, but it does not account for its origin; that,

further, it is the artificiality of the higher forms of speech which hides from us both the nature of speech itself and its origin. The origin of speech is in the nature of human mentality. Reason in its human form would not and could not exist without speech. The very concept of reason implies discourse, for reason is an activity directed from within outwards. Speech is expression. Self-expression is already speech though the individual mind have no audience but itself. It is this self-expression which becomes communicable, not on the analogy of physical objects passing from hand to hand, but on the analogy of a sympathetic emotion which, in passing from individual to individual, never ceases to be self-expression in the individuals who experience and communicate it.

The philosophical truth which to me seems to underlie the whole problem is that neither in science nor in philosophy do we ever reach the conception of a reality which is a simple homogeneity quantitatively determined. The ultimate reality, whether it be the electricity of the physicist or the activity of the metaphysicist, can only be conceived as opposition. Heracleitus of Ephesus had the true insight. He said: "Homer was wrong in saying: 'would that strife might perish from among gods and men!' He did not see that he was praying for the destruction of the universe; for if his prayer were heard all things would pass away."

THE END

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